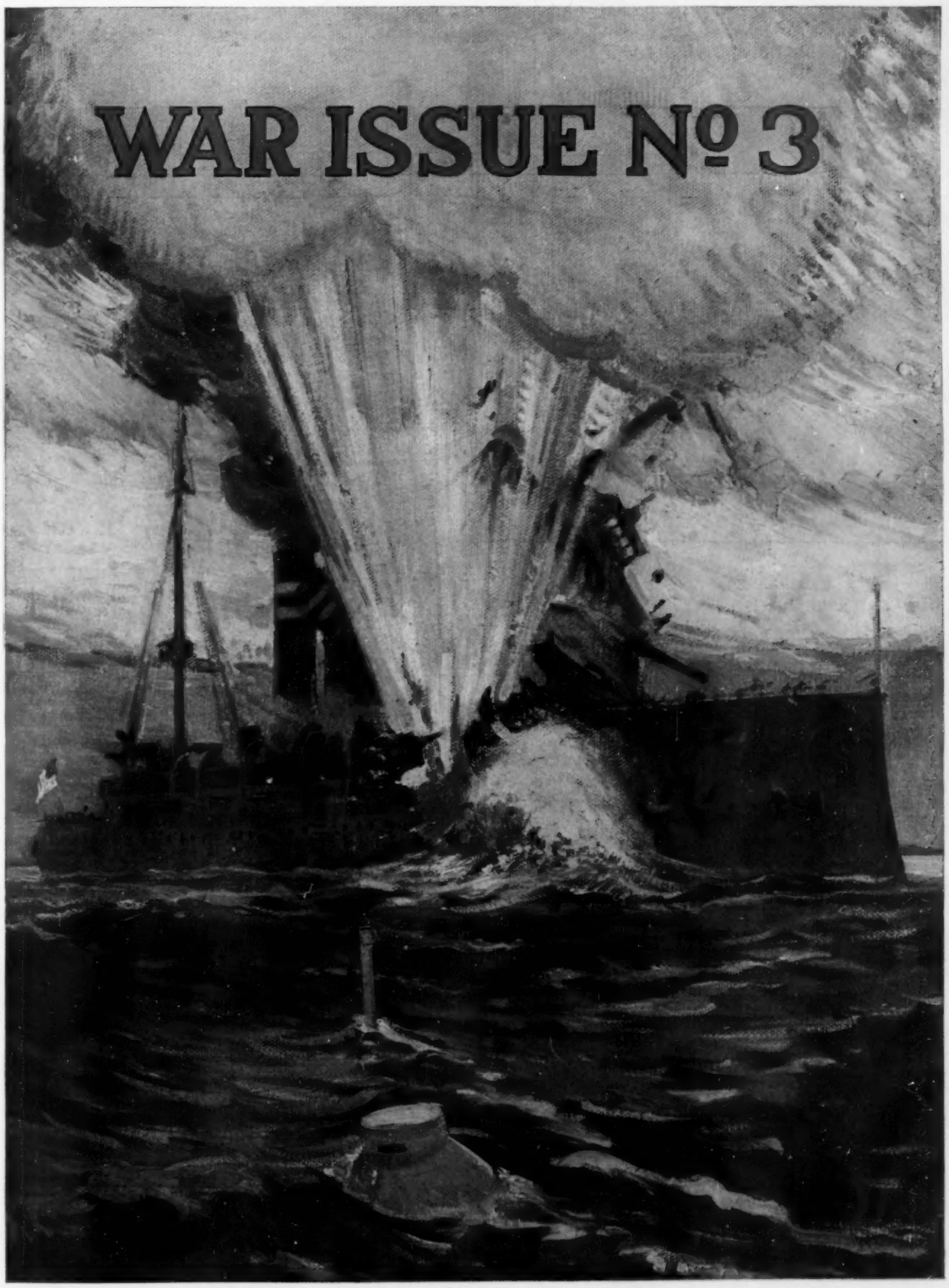
SCIENTIFIC AMERICAN

WAR ISSUE Nº 3

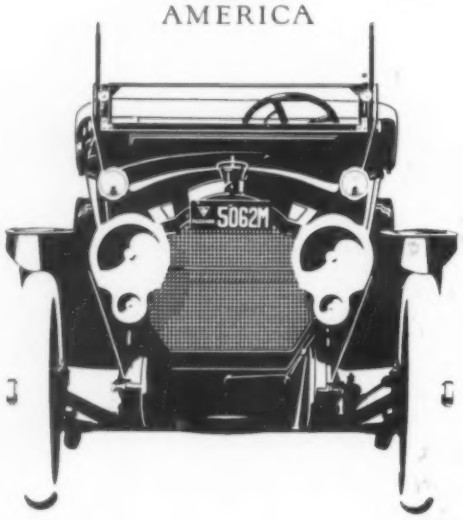


Vol. CXI. No. 19
November 7, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 25 Cents
$3.00 A Year

A Blend of Brute Force and Perfect Poise



Packard
MADE IN AMERICA

WITH the new Packard "5-48" comes a sweeping readjustment of values as applied to the road ability of motor cars. The latest Packard Six is not measured in terms of mere horse power and miles per hour. It is a blend of brute force and perfect poise. It conveys a soothing consciousness of surplus power free from vibration or other evidence of working mechanism.

Never before have motorists experienced such pick-up, such easy mastery of grades, or such instant response to every power requirement. The Packard "5-48" is the Boss of the Road.

Ask the man who owns one

PACKARD MOTOR CAR COMPANY
DETROIT · MICHIGAN

DELCO

ELECTRIC CRANKING LIGHTING IGNITION

What Electric Cranking and Lighting have done for the Automobile

We stated in an advertisement some months ago that "The Delco System has revolutionized the Automobile Industry."

This is literally true.

The Delco System was the pioneer in the Electric Cranking field.

When it first appeared it was looked upon with suspicion, and condemned as impractical by automobile and electrical engineers.

But it made good so emphatically and decisively that inside of a year there was a universal demand from automobile buyers for electric starting and lighting.

Today there are 173,000 Delco equipped cars in use, and every automobile built to sell at $750 or more has electrical equipment of some kind.

The Delco system through its effective pioneering work and its continued leadership actually has revolutionized the automobile industry.

It has immeasurably broadened the scope of the automobile.

It has so simplified driving that thousands of men and women who would not undertake to handle a car in the old days of hand-cranking and troublesome lighting systems are now enjoying the pleasure and exhilaration of driving.

It has added greatly to the safety of driving—by making it possible to start the car instantly when the engine stalls in a dangerous place—by furnishing a brilliant, reliable light for night driving—by eliminating the chance of a broken arm in cranking.

And it has made possible a great many refinements in motor car construction.

It is no longer necessary to sacrifice efficiency or long life in order to secure a motor that can be easily cranked.

Electricity takes care of the cranking now—and the gasoline engine designer can devote all his attention to the development of power and economy.

With electric cranking it is also possible to make carburetor adjustments much finer than in old days—thus not only developing more power but increasing very considerably the mileage per gallon of gasoline.

Hence, we have as a result of the revolutionary movement that was started by the introduction of the Delco system—

A greatly increased market for automobiles.

Greater ease and pleasure in driving.

Greater safety.

Greater engine efficiency.

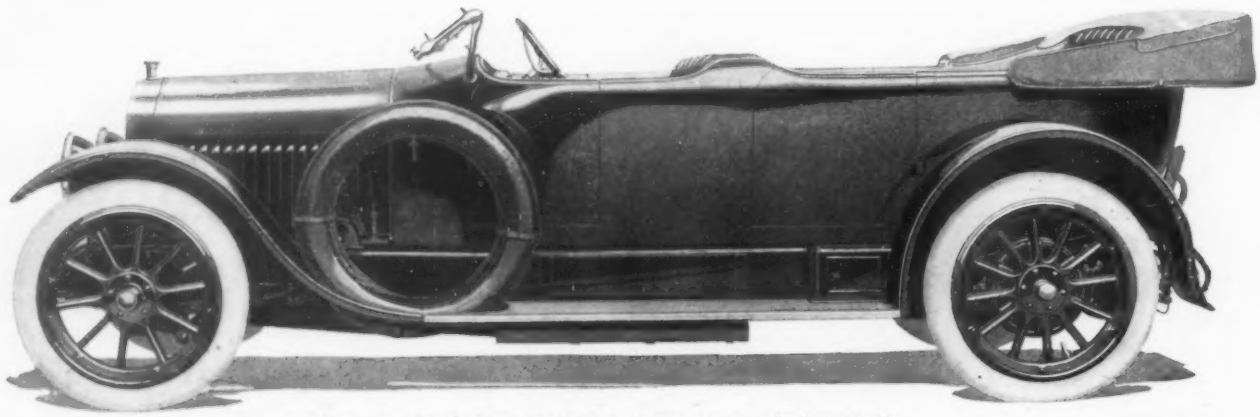
Better carburetion—more power and more miles per gallon.

And in addition a more efficient and reliable system of ignition than was ever before developed.

The Automobile of today is a better car than was dreamed of a few years ago.

The Delco electric cranking, lighting and ignition system has helped to make it so.

THE DAYTON ENGINEERING LABORATORIES CO. DAYTON, OHIO. STARTING LIGHTING DELCO IGNITION



White 4-45. Completely equipped—Mono-top, rain vision ventilated windshield, speedometer, electric signal, trunk rack, Silvertown Cord Tires.

· THE · LATEST · WHITE

Leadership in Body Design Added to Leadership in Mechanical Construction

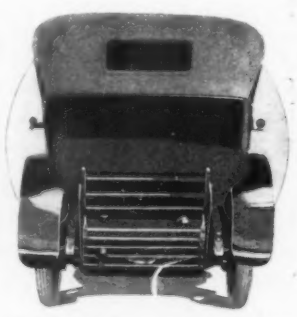
THE insistence upon quality which has always dominated the mechanical construction of White Motor Cars is now given expression in every line of the body.

Observe the application of the "stream-line" to the front of the car—the most difficult place to achieve the proper result

The latest White presents the finally-perfect stream-line—without a break, without an angle. The eye sweeps naturally and easily along and over the entire car.

Even the conventional back of the front seat—always awkward in appearance—is gone—absorbed in the artistic double cowl effect.

In these latest productions no detail has been omitted which would give The White an external appearance on a par with the mechanical goodness which has been the strength of the phrase, "KEEP YOUR CAR."



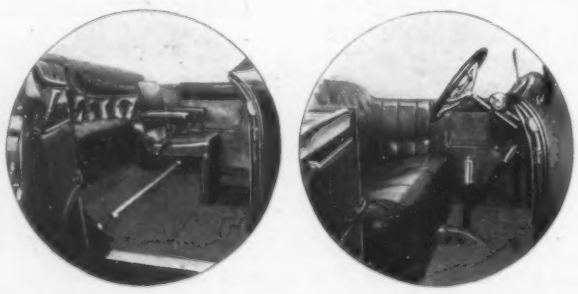
There is refinement and dignity here which fulfills the promise suggested by a view from any other angle

White leadership is a principle

The important and fundamental improvements in automobile construction and operation—the features that are exploited most widely today—have been basic principles in White Cars for years.

In 1909 The White presented the first monobloc, long stroke, high-speed motor—the type of motor heralded as a sensation today, and which has proved its superior efficiency so often.

In 1910 The White presented the logical left-side drive—the first high grade car to break away from European traditions and give the American public the proper drive for American traffic rules.



The wide doors open into roomy compartments; the fittings are what you expect in such a car. The seats are low, with heavy straight-grain leather upholstery—the sensation is that desirable one of sitting *in* the car, not *on* it. The dash is clean; the control is unified and concentrated on the steering post; the leg room is more than ample.

In 1911 The White presented electrical starting and lighting, with the tremendous advantage of the non-stallable engine, and White foresight gave to the public the system that has so universally proved its superiority—at a time when mechanical, pneumatic and explosive starting systems were at the height of their popularity.

From time to time other important improvements have been perfected and then brought out in White Cars. The White is replete with dominating ideas in mechanical construction and in the attributes of comfort and beauty.

WHITE DEALERS WILL GIVE FULL INFORMATION CONCERNING THESE LATEST WHITE CARS

THE WHITE COMPANY, Cleveland, Manufacturers of Gasoline Motor Cars, Motor Trucks and Taxicabs

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

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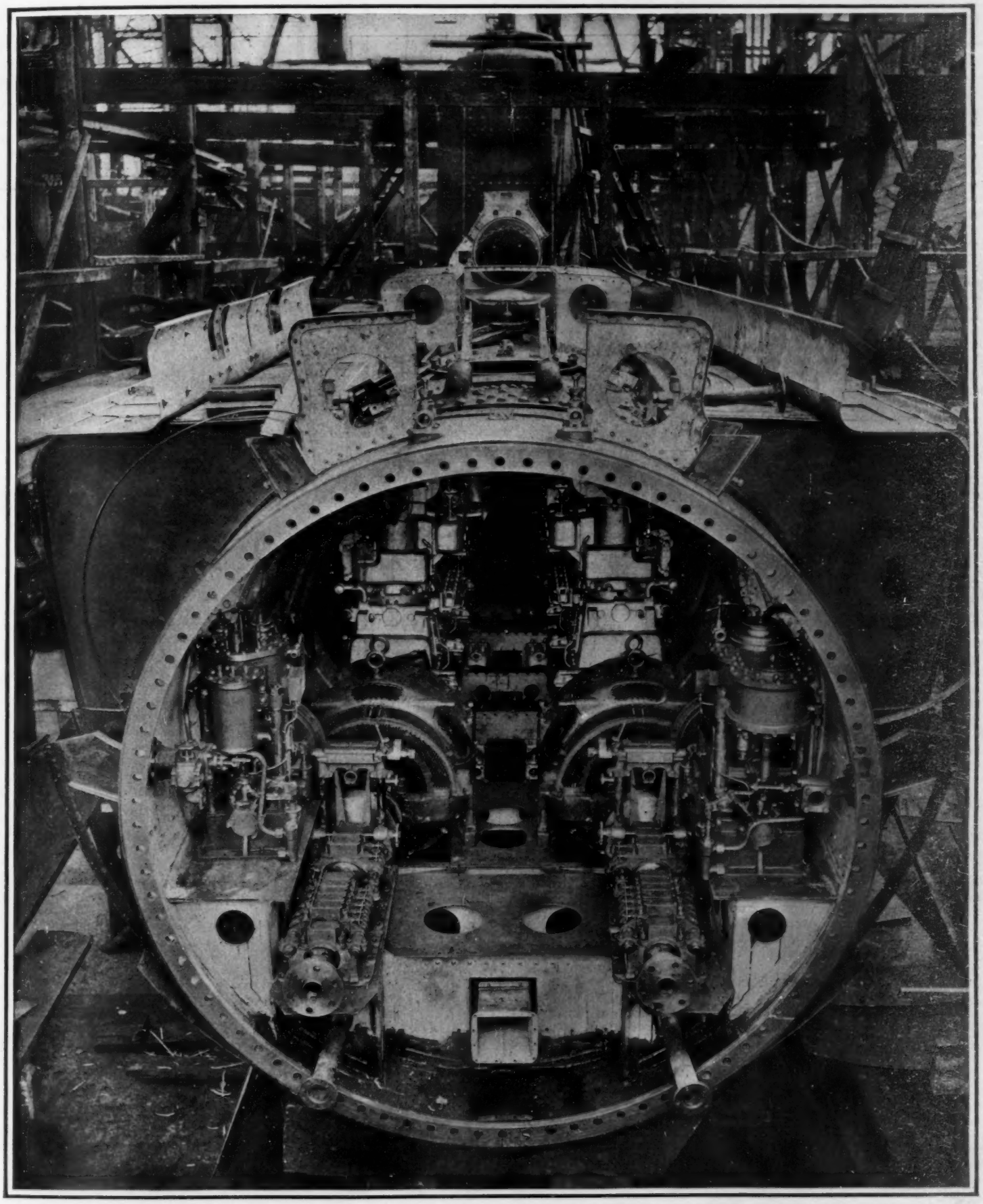

View of the interior of a German submarine before the rear section was bolted on. Note the thrust bearings, the electric motors, and the gasoline engines.

MODERN SUBMARINE WARFARE.—[See page 376.]

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Mechanical Fatigue in a Machine-made War

THIS is very largely a machine-made war, and it would be a curious and not altogether illogical *denouement* of the great struggle if its end should be hastened through the fatigue of the machine rather than the exhaustion of the man.

This war is being fought with the gun and the motor-car; and so strenuous and uninterrupted has been the struggle that these have been put to a test of endurance the like of which has never been witnessed in the history of artillery or the briefer but very strenuous history of the gasoline car.

The life of the gun, so far as its absolute destruction by bursting is concerned, is practically unlimited; but not so its accuracy-life. Every time a gun is fired some of the interior surface of its bore and delicate rifling is wiped away, and a certain degree of its accuracy is lost. This is true of the shoulder rifle, with its bore so small that it would not much more than admit a lead-pencil, no less than of the great 16-inch siege gun of the Germans. Fortunately for the infantryman, the wearing out of the bore decreases rapidly with a decrease in the size of the bore. Erosion, as it is called by the artillerymen, is greatest in the large guns and least in the 0.30 rifle. The big guns which form the main batteries of our warships and are emplaced in our coast fortifications can fire from 150 to 250 rounds (dependent upon the pressure and heat in the powder chamber) before they begin to lose their accuracy.

No such loss of ballistic qualities is occurring in the German howitzers and siege pieces, however, and this for the reason that the velocity, and therefore the pressure and the heat of explosion in the powder chamber are very much lower in the howitzer than in the direct-fire high-velocity gun. Nevertheless, their heavy siege pieces, like everything else in the German army, are being worked at top pressure; and already the German artillerymen must be beginning to find that there is a discrepancy between the estimated and the actual point of fall of the high explosive siege-gun shells.

As regards the 3-inch field pieces, although, according to the law, the erosion of the bore is less as the diameter of the bore gets smaller, we must remember that these field pieces have been worked, most of them to their full capacity, for some three months of the hardest and most continuous fighting the world has ever seen. A large percentage of the 3-inch field pieces, both of the Germans and of the Allies, must show serious deterioration. Hence, if the efficiency of the artillery big and little is to be maintained, there must be a continual process of renewal going on. The worn-out guns must be taken from the fighting line, shipped back to the arsenals and gun factories, and either rebored and relined, or else absolutely new weapons must be sent out in their place. But how is this to be done over roads that are already congested with the enormous supplies of food and ammunition and the heavily loaded trains of reserves and wounded?

Even more severe must be the depreciation which is going on in the motor-car transport service. The motor car is a highly developed machine, which calls for careful upkeep to maintain it in full efficiency. In ordinary commercial service the motor car and the automobile receive, as a rule, considerable care and watchful maintenance. In the present war, however, the treatment of these vehicles, must, in the nature of things, be absolutely brutal, and the depreciation must be very rapid. Where are the repair shops that can keep pace with this depreciation, and how shall the necessarily enormous wastage of the war be made good?

It may well be that the fatigue of the machine rather than the weariness of the man will hasten the close of the present war.

Feeding the German People

AS time passes without any signs of abatement of the military operations and the isolation of Germany is becoming constantly more complete, it is very apparent that the question of supplies for the German nation must soon become most pressing, not only as regards military material, but especially in the matter of food, for food is as essential to success as guns.

This question has been frequently discussed, but mostly in the way of considering recent claims put forth by Germany, or the public statements of Count von Moltke, made early in the year, that Germany could produce within her own borders all the foodstuffs necessary for the maintenance of her people for an indefinite period.

The fact, however, has apparently been overlooked that in his estimate Count von Moltke reckoned that it would never be possible to close the German ports against importations; and he furthermore was undoubtedly misled by the statistics which showed that importations of food grains had decreased during the past few years, and moreover that Germany has even been exporting considerable quantities of rye of late.

It is very likely that these same views were also held by the German government, and if that is the case a brief review of some further facts and statistics, also from German sources, will show what a most serious error was made in estimating food supplies, as has also been made in other vital matters.

These facts are furnished by Dr. Carl Ballod, a professor of the University of Berlin, and an authority on the subject he discusses in an article that appeared in the *Preussische Jahrbücher*, the same publication that contained the statement of von Moltke. As an offset to the grain exported, which can now be added to the home supplies, Dr. Ballod calls attention to the fact that in 1912, according to the latest statistics available, Germany imported ten million tons of grain and fodder, and in addition to this the equivalent of five million tons of food grains in the form of cattle, meat, tallow, herring, eggs, butter, and cheese, valued at nine hundred million marks ($225,000,000).

Accepting the German harvest statistics of twenty-six million tons net of grain of all kinds as correct, it is apparent that in 1912 Germany imported at least one third of her necessary food grains. But Dr. Ballod goes further, and, after examining the methods employed in collecting the harvest statistics, he concludes that the estimates are at least fifteen per cent too high, and that the amount of food grain produced in 1912 amounted actually to only about twenty-one million net tons; so the home resources are in this direction very much less than what has been relied on.

With the cutting off of the sixty per cent of her fodder supplies, which was imported, it would be impossible to sustain all her domestic animals, and it would become necessary to slaughter large numbers of cattle; and although this would add considerably to the temporary supply of meat, it would by no means make up for the loss of the amount ordinarily imported.

What proportion of the imported food grains were derived from the United States, Canada and South America is not stated; but the amount must have been very considerable. Dr. Ballod makes a survey of conditions in the various neighboring countries from which supplies might be secured, notwithstanding a blockade of Germany's ports, cutting off transatlantic importations, if such material were available; and his conclusion is that no European nation produces more in the way of foods than it requires for home consumption, and in most cases it is necessary to add to their resources by importation. In ordinary years Austro-Hungary has absolutely no surplus, and at the present time requires all it has, and more. Roumania is a possibility; but her friendship is doubtful. Even if the grain ships from across the sea could reach the open ports of Norway, the single track railways, with high rugged mountains to cross to reach the Swedish ports in communication with Germany, could hardly be relied on to transport the necessary quantities.

Another feature of the problem that arises is that in making her estimates of home production, Germany never supposed it would be necessary to call out practically her entire male population; and as this has apparently been done, it will certainly result in an immense diminution of her resources, although it is probable that a large portion of her harvests had been gathered before her fields were denuded of workers.

A point that Dr. Ballod discussed at length was the establishment of great depots in various parts of the country, where food might be collected and stored in anticipation of war conditions; but his remarks convey no intimation that this has been done, nor has any suggestion of the kind come from other sources. While undoubtedly a large amount of specially prepared food for the army was provided for, the question that threatens to confront Germany in the near future is that of feeding her entire population, and, judging the prospects wholly from these home estimates, the outlook is far from rosy.

An article appearing in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT deals with this question of Germany's food supplies, and gives Dr. Ballod's figures and arguments quite fully.

Immigration in 1914

IN the course of the epochal weeks which have just passed, the closeness of our relationship to the rest of the globe has been brought home to us in a most forcible manner through many channels. No longer, we now realize, do we stand apart, splendidly isolated. Steam and electricity have brought all peoples to our threshold, indeed, far within our house. Nations cannot now live to themselves alone. The forces that play upon the life of one, are felt in the brotherhood of nations. This has been markedly illustrated in the story of the migrations of the year, not only of those ending and beginning in the United States, but those flowing between other countries.

The most evident fact about the flow of the current of American immigration is that since the war there has practically been none. Nowhere in the written record of our immigration is there anything to indicate that the stream has ever before been stayed so abruptly in its course, or reduced to such a small volume in proportion to its ordinary flow. The sudden introduction of this fresh factor among the influences regulating the current offers ample opportunities for the exercise of the abilities of the would-be prophet. This is the first time the expert has been permitted to study the relationship of immigration and a great war which affects the sources. Since the means of easy transportation and intercommunication became available for practically all classes of society there has been no war comparable with the present one to serve as a guide in formulating a prognostication. The problem is complicated by factors previously non-existent. It is quite generally assumed, however, that conditions in Europe following the immense and inconceivable destruction of wealth, will stimulate immigration when the war is concluded. The loosening of provincial ties resulting from campaigning will tend, doubtless, to make it easier to forsake the homeland, and the widowed and fatherless among the womenkind may find it to their advantage to emigrate to a country which needs servants.

The Government's custom of ending and beginning its year in the middle of the calendar year eliminates from the record of the one recently closed any evidences of the effect of the war upon immigration. The record, however, does show very clearly the growing sensitiveness of human world currents to local conditions. This was the distinguishing characteristic, not only here, but in the records of other lands. Had the flow continued through the second six months at the same rate that it did through the first, a new record would have been established, for more than 800,000 immigrant and non-immigrant aliens knocked at our gates between July 1st and December 31st, 1913. This, ordinarily, would have meant admissions exceeding 1,600,000 for the twelve months, the greatest known migration in a single year. The flow was checked, however, in February, and the total number of aliens admitted was only 1,403,081, a number slightly less than that of last year.

The reason for the abnormal volume in the first half of the year, was not, as is usually the case, particularly favorable economic conditions here, but extraordinarily bad at home, coupled, in Italy, with a desire to get into the country before a literary test could be adopted. Unfavorable conditions in Austrian and Russian Poland stimulated the flow of Slavs from that region, the Balkan war being responsible in a measure for the poor crops in Galicia. Floods supplemented the evils occasioned by the calling of the laborers to the colors. The Jewish boycott in Russian Poland tended to augment immigration from that region. The Stolypin act of 1910, which freed the peasants from the land, and the close of the Balkan war are responsible for the relatively large immigration of Russians and the record movement of Slavs from the Balkans.

The Argentine immigration was smaller last year than usual, owing to poor crops and the consequent reduced demand for labor. Upward of 300,000 Italian "birds-of-passage" supply Argentina's annual needs, the ebb and flow of this great human tide being facilitated by competition between the lines which resulted in a one-way rate of $7.50. Economic conditions in Canada before the war broke out were so bad that the outward movement of immigrants was greater than the incoming.

Electricity

Street Car Lines Needed in Nassau.—A consular report from W. S. Doty, United States Consul at Nassau, Bahama Islands, calls attention to the need of an electric street car system for that city. He suggests that light storage battery cars might be used and that for the city twenty cars would be enough to start with. The line could be extended, after it had been well established, to The Caves, Orange Hill, Old Fort, and, eventually, as far as Clifton and Southwest Bay.

England's Street Lights and the War.—One of the many inconveniences that England has to indure on account of the present war is a shortage of electric light carbon. This has become so serious in some localities that in several towns, arc lamps are no longer used for street lighting, and one town lights it lamps only on Saturday nights, which is the shopping night. Before the war carbons were largely imported from Germany and also from a factory at Nancy in France. As these sources of supply have been cut off the price of carbon has mounted materially.

Transcontinental Electric Vehicle Run.—The Electhic Vehicle Association of America is planning to have a transcontinental run next summer over the Lincoln Highway. To this end mileage tests were held on the indoor track of the Grand Central Palace during the recent electrical show. It is expected that both pleasure and commercial vehicles will enter the run. The distance between New York and San Francisco by the Lincoln Highway is 3,389 miles. No doubt the route will be used very extensively by motor vehicles of all classes next spring.

Improved Battery Tester.—For use in field telephone work, the convenient little battery cell tester shows the condition of the cell. The device consists of a small flat pocket box with compass, galvanometer, buzzer, and three-contact slide switch. The galvanometer shows the condition of the cell and the direction of the current. By means of the buzzer the strength of the cell can be tested. Putting on the buzzer by the switch produces a loud humming sound if the cell is in perfectly good order. Should the buzzer give no sound, the cell is to be condemned as useless. It takes but a few seconds to test a cell.

French Wireless Lighthouses.—The French government is taking measures to set up wireless lighthouses along the coast, and as is customary for ordinary lighthouses, each station sends out flashes every few seconds along with a characteristic signal. Automatic sending apparatus is used for the purpose, and it will run for 30 hours at a time. Fogs will no longer hinder signals, and these can be picked up by vessels when they approach within 30 miles of Brest, for instance, where one pair of posts is placed. As the exact positions of the lighthouses are known, the relative strength of the signals will aid in finding bearings, but it is still better to have a special apparatus on board to detect the direction from which signals come. The port of Havre is to be equipped shortly with two such lighthouses.

A Waterproof Cast Iron Telephone.—A useful apparatus of London make is a waterproof cast iron telephone set, which consists of a substantial iron box to be mounted on the wall, and hanging from it is a hearing tube made up of flexible steel spiral tubing with an ear-piece at the end. On the front of the iron box is the transmitter mouthpiece, but the arrangement of transmitter within the box is a special feature. Usually the transmitter can be reached through the perforation at the back of the mouthpiece, and is thus subject to accidental or willful damage. Here it is impossible to reach it, for the transmitter lies within the box and higher up than the mouthpiece, being connected to the latter by an acoustic tube. An inclosed telephone receiver is connected with the outside hearing tube above mentioned.

In the Usual Types of Wattmeter for measuring the power taken by a given electric apparatus, there is used a fine wire movable coil which takes the voltage of the circuit and next it a heavy wire coil carrying the current, and the attraction between the two coils causes a swing of the pivoted one with its needle so as to give the scale reading of the power in watts. However, it is very desirable to have an instrument which will allow of measuring power in small apparatus and then of large dynamos or motors without needing several fine and heavy instruments to suit the case. A new instrument which is made at Paris is designed to give a range as high as 30,000 watts and from this down to 1 watt. This is done by using a number of removable coils, and each of these fits into the instrument about as a drawer is slid in, as it is made up in a wood block shape. All that is needed is to take out the low power coil and put in one of a higher power, and the scale reading (1 to 100 degrees) is multiplied by a figure representing the coil which is used. The pivoted coil remains the same, and is thus acted upon by coils of various kinds. Both direct and alternating current can be thus measured.

Science

Spitsbergen, the political status of which is still unsettled, will hereafter be linked more closely than ever to Norway, in virtue of a subsidy recently granted by the government of the latter country to a Norwegian steamship company, which has undertaken to make at least six trips to Spitsbergen each year, beginning next spring. On the first three journeys of the year the steamship will endeavor to communicate with the various fishing vessels in that part of the Arctic. It will be equipped with wireless, and will carry passengers, freight, and mail. During the last summer extensive surveys were carried out in Spitsbergen by a Scottish expedition under Dr. W. S. Bruce. This work was cut short by the war, and the party returned to Scotland September 18th.

The Demarcation of the Alaska-Canada Boundary from the St. Elias Range straight north along the 141st meridian to the Arctic Ocean has been in progress since 1907, and is reported to have been completed during the past summer. This undertaking was notable for several reasons. No other modern boundary demarcation has extended into such high latitudes, and few boundaries of equal length anywhere in the world are so straight; the line follows the meridian without the slightest deviation, regardless of mountains, swamps, and forests. Wherever the boundary passes through timber and brush a 20-foot clearing has been made. Monuments have been set up along the entire line, at points visible from each other; generally at distances of three or four miles. At important points these monuments are 5-foot shafts of aluminium bronze, weighing 300 pounds, set in 2,000 pounds of concrete. The boundary is 600 miles long, and is marked by about 200 monuments.

The Influence of Atmospheric Conditions on Animal Metabolism.—An interesting paper presented by W. Thomson to the Manchester Literary and Philosophical Society gives the results of a series of observations on the amount of carbon dioxide in the air exhaled from the lungs of human beings and animals in relation to the current barometric pressure, humidity, and temperature. These observations showed quite uniformly that a rise in barometric pressure, humidity, or temperature is accompanied by a decrease in the amount of carbon dioxide exhaled, while a fall in any of these produces an increase in carbon dioxide. These relations to the ordinary fluctuations of the weather were confirmed by such experimental observations as that the percentage of carbon dioxide in the exhaled air was greater when the inhaled air had been previously dried with sulphuric acid; that the percentage was greater at high elevations than in valleys; and that it was greater when the body was surrounded by cold air than when surrounded by warm air.

A School of Forestry in the Philippines, which was established in 1910 as part of the College of Agriculture, University of the Philippines, has made excellent progress, and has been well attended. The college and school are situated near Los Baños, at the base of Mount Maquiling, about forty-two miles from Manila. The mountain, which is almost wholly forested, constitutes a forest reserve of about 15,000 acres, furnishing the students ample practice in the various branches of forestry. Besides general work in the reserve, each class is expected to improve one hectare (two and a half acres), making a modest forest on a small scale to remain as a monument to the class. The course covers two years. Students are selected from all parts of the Islands. On graduation they are sent to provinces other than their own, and after four years' service they are to return to their home provinces. One of the difficult features of forestry in the Philippines is the great number of tree species, all of which the forester should be able to recognize. The Philippine Herbarium contains specimens of more than 2,500 species of trees.

Tibet continues to hold its special fascination for explorers, and it is therefore interesting to learn from the experiences of Captains Bailey and Morshead, who recently cleared up the long-standing mystery concerning the connection between the Tsangpo and Brahmaputra rivers, that a noticeable change has come about in the attitude of the Tibetans toward foreigners. These explorers encountered no signs of hostility or distrust, except when they were mistaken for Chinese, who appear to be held in great dread. No objections were made to the surveying operations, and Capt. Morshead asserts that "it is now possible to traverse the country from end to end, openly, with plane-table and theodolite, and without even the formality of a pass from Lhasa." Apparently the Tibetans have learned that the British are their best protectors from Chinese aggression. Apropos of the Tsangpo-Brahmaputra, the current number of Petermann's *Mitteilungen* announces that the Austrian explorer, A. K. Gebauer, who is now traveling north from Burma along the Chinese-Tibetan border, intends ultimately to strike west to the Tsangpo and follow this river through the passes of the Himalaya.

Automobile

An Aid for Stalled Automobiles.—C. L. Parish and F. C. Ferrell of Harrisburg, Ill., in a patent, No. 1,108,221, supply a traction device for a stalled automobile in which a toothed rack-bar is suitably anchored and a toothed pinion meshing with such bar is applicable to the hub and spokes of one of the drive wheels so the operation of the engine can push the automobile out of the rut.

Gasoline as a Factor in War.—In the present European war gasoline has come to be regarded so much a necessity that it has been referred to in some quarters as a war of gasoline. Should the supply give out and no substitute develop, it may play a large part in the termination of hostilities. Possibly the demand for a motor explosive may cause the European chemists to develop a substitute for gasoline or a means to supplement a limited gasoline supply.

Motor Transports of the Russians.—A correspondent of a London paper, who was present at some of the military operations in East Prussia, tells of encountering a train of military motor transports on the road near the fighting line, each truck loaded with about thirty men, packed like sardines. "They were traveling like no motor wagon that I ever saw—certainly at not less than forty miles per hour. The procession seemed endless. I didn't count them, but there were not less than a hundred, and perhaps a good many more. That was Gen. Rennenkampf reinforcing his threatened flank."

Exterminating Prairie Dogs.—A correspondent in South Dakota writes that in his part of the country the automobile has been found a great success as a prairie dog exterminator. A piece of hose slipped onto the exhaust conducts the gases into the dog hole for a few minutes, when the hole is covered with earth. That is enough for the dog. Of course some automobiles are more efficient in this sort of work than others, and the machine with an exhaust that will kill a dog might find favor in some other parts of the country as well as on the prairies; but manufacturers are not likely to lay much stress on this feature of their machines.

Few German Military Vehicles.—In view of the present Franco-German imbroglio, it is interesting to note that in March of the present year Germany had but 1,225 motor trucks of a type suitable for military use. Of these, 825 actually had passed the military requirements and their owners had received subventions. The subvention amounts to 3,000 marks or about $750 for an army wagon with one or more trailers, and 1,800 marks or about $450 for an ordinary truck. This amount may be considered the purchase price, although for the succeeding four years the owner receives as a premium 1,200 marks, or $300 annually for an army train and about $200 annually for an ordinary truck. These 825 vehicles were supplied by 15 makers.

Rear Gasoline Tanks and Tail Lamps.—The placing of the gasoline tank at the rear of the chassis has become such common practice that the tail lamp becomes of greater importance. It is well that electric lighting has made such strides, for in the modern car there is little danger from a leaky tank in this position. But what of the older cars that were built with rear tanks, and which still have oil tail lamps? With them the danger is real. Obviously, a person with even a modicum of common sense will put the light out when his fuel supply is replenished. But no one can be expected to keep the close watch for leaks that the juxtaposition of an oil lamp and gasoline tank requires. Perhaps some sort of a lamp built on the type of a miner's lamp might better preserve the car and its contents; but still even a lamp of this kind can be broken, and there is always the danger of rear end collisions.

Fuel for Automobile Motors.—A number of efforts have been made abroad to stimulate the development of internal combustion motors suited to the use of alcohol, and its introduction as a fuel for automobiles, and various experiments have been made and competitions held with this object. Recently a series of tests was conducted on the Brooklands track in England by the Royal Automobile Club with a 15-20 horse-power car, using gasoline, benzole, and alcohol, and it is interesting to note that an improved modern engine can be operated successfully with either of these fuels, the only change necessary being a slight adjustment of the carbureter jet. With gasoline an average of 36.8 miles per gallon was made; with benzole, 40 miles; and with alcohol, 23.2 miles. With a half and half mixture of the two latter fuels the consumption was a gallon per 32.4 miles. As is well known, it would be necessary to increase considerably the compression over what is desirable with gasoline, to obtain the best efficiency from alcohol; and to secure the same power results the size of the engine would have to be increased. Still this test will emphasize the fact that any good modern engine can readily be adapted to work on alcohol, although the present price, owing to Government duties, prohibits its regular use.

Photo by Bain.

Belgian artillery in maneuvers.

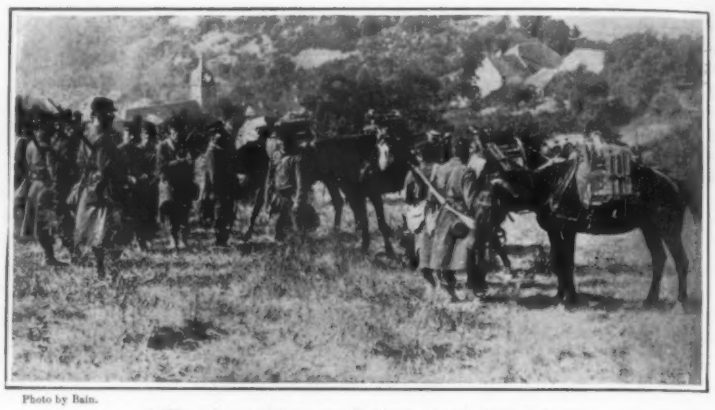

Photo by Bain.

A French machine gun battery carried on horses.

The Efficiency of European Armies

The War a Struggle Between Highly Trained Men

By H. Bannerman-Phillips

THE efficiency of the French army may well claim priority for consideration in any discussion of the comparative value of the European troops now in the field and at close grips with one another. In regard to the human material, the Frenchman, as is well known from the times of the armies of the first republic and of Napoleon, makes a good soldier. His dash, spirit, and marching power are valuable qualities. His vivid imagination and superb initiative—the latter an important asset when exercised within reasonable limits—are calculated to enable him to cope successfully with the exigencies of modern warfare. The army of the French Republic of 1914 is very different from that of the Empire in 1870. This time the superiority of its arrangements in peace time has been shown by the smoothness with which mobilization has taken place. In 1870 the leadership was hampered by the defective personality of Napoleon III and the supposed exigencies of a policy based on dynastic considerations; now we may assume, from the accounts of the fighting which have reached us thus far and the known views of the leaders, that the army is imbued with dauntless energy, but cherishes no illusions as to the magnitude of the task before it, and is well led. Thanks to the moral and material assistance afforded by Belgian heroism and self-sacrifice, and to British support, it has been enabled to make what are presumably the best possible dispositions for meeting the long-threatened attack over ground which is known and under conditions which its leaders have had under earnest consideration for years.

The French General Staff has based its study of war upon the campaigns of Napoleon and the Franco-German war of 1870-71, and the Army Regulations have been revised from time to time in the light of modern improvements, the advent of reconnaissance from mobile aircraft, and the conduct of recent campaigns. The French leaders realize, no doubt, that in the presence of an enemy which, like the Germans in the present instance, has taken the initiative in operations, it is possible only by a vigorous counter-offensive to give a favorable turn to the conflict. They realize that only the offensive leads to positive results and are prepared to take it with "*élan*" and fury, but they have also apparently that invaluable quality of iron self-control which will prevent them from playing into the enemy's hands by too impetuous action against superior numbers. They will endeavor by strategical action to create situations favorable to themselves before risking the expenditure of all this force on decisive action, rather than accept situations created by the disposition of the enemy. If they retire, it will be a case of "*réculer pour mieux sauter*"; their retirement will have nothing of timidity about it. They will keep reserves in hand to protect their flanks and to form points of support, but they will use them in the final resort to reinforce the fighting-lines and turn imminent disaster into assured success rather than to cover a retreat.

Photo by Bain.

Gen. Joffre, in supreme command of the French forces.

In regard to numbers and weapons, the strength of the French army is about 4,000,000 men, as far as can be ascertained, divided into twenty-one army corps, for service in Europe, while one army corps is absorbed for Algeria. The rifle used is the Lebel of 31 caliber, somewhat out of date, but which seems to be giving a good account of itself, nevertheless.

The French army is somewhat deficient

Photo by Paul Thompson.

British machine guns carried on cycles.

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A German field-piece and its firing squad.

in heavy artillery, but their Creusot field-guns are undoubtedly superior to the German weapons and their gunners better trained. Staff officers are most capable, the rank and file of the army have the utmost confidence in and good feeling toward their officers and are prepared to follow them anywhere, and France has every reason to be proud of the latter, from the superior leaders down to the most junior subaltern.

The British Army in War.

The British Expeditionary Force sent over to the Continent, which is sharing the brunt of the most violent and deliberately calculated onslaught of carefully disciplined, picked, and well-equipped troops in superior numbers which has ever been delivered in the history of armies, consisted of men in the prime of life for fighting purposes as regards the majority, of good physique and perfect condition, led by officers, of whom many have had considerable experience in war, though, of course, not of continental warfare. Their equipment was complete in every detail; the rifle, a magazine Lee-Enfield, is an excellent one; the field guns are good, the heavy 60-foot field-guns exceptionally so. The training of all arms has been, since the Boer war, more thorough, more practical, and more elastic than at any previous period of history since the introduction of the modern magazine rifle. Both cavalry and infantry realize the importance of rifle-fire, and while always ready to make the utmost use of the "arme blanche" on occasions, know that it is the bullet (rifle or shapnel, but especially the former) which wins battles, however useful the saber, the lance, and the bayonet may be at critical moments. The cavalry, according to French accounts, which are supported by British official reports, have fought magnificently against superior odds; even their own officers are said to have been astonished at the Berserker-like fury of their onslaught. It has been said of the British soldier that he is at his best in a tight corner and with the odds against him, and his long service with the colors enables his officers to give him, assisted as they are by a most competent and efficient body of non-commissioned officers, a thorough training in musketry. Both these facts have been proved on the evidence of foreign observers in the present campaign. A German officer, taken prisoner at Mons, said of the infantry fire: "It was staggering; we had never expected anything like it." Withdrawal in face of the enemy is notoriously a most difficult operation, and the danger was heightened after Mons last August by the fact that the enemy was not only fully aware of the critical position of the British forces, but desperately anxious to break down their opposition, get through the allied lines, and pursue their objective—the advance on Paris—against time, with the knowledge that the Russian invasion in East Prussia was all the time making unexpected headway and would soon involve a withdrawal of German troops from France to strengthen the defense of the line of the Vistuia. It must be remembered, also, that the men opposed to the British troops were the flower of the German army, troops of which any war-lord might well be proud, and in which the Kaiser justly placed the utmost confidence, and that in numbers of machine guns, field guns, and cavalry (besides infantry in the proportion of three to one, at least) they were far superior to their opponents, and were ably assisted by aircraft in reconnaissance and observation of artillery fire. The quality of the British army and its efficiency were better shown by the skill and tenacity which were displayed in a retirement in face of superior numbers during four days' fighting, August 23-27, under extreme pressure from the enemy than by the most brilliant victory under more favorable conditions. Not a gun was lost of which the horses had not all been killed or the gun itself destroyed by the enemy's high explosive shells, and though the British casualties were estimated at between 5,000 and 6,000 men, the enemy's losses were enormous and out of all proportion to those they caused. It is a tribute to British military organization that not only was the mobilization of the expeditionary force and its dispatch to the Continent effected with complete smoothness, but that every gun lost in the four days' fighting referred to above was immediately replaced by another and the losses in men were made good by reinforcements of double the number in readiness for further fighting.

Copyright by George Grantham Bain.

English infantry in France.

Photo by Bain.

French infantry firing from a standing trench.

Russia and Her Forces.

We now come to the third and largest army of the Triple Entente—the Russian. It is organized in twenty-seven army corps; we know that its peace strength alone is 1,500,000 men, and the source of supply of human material is practically limitless. As many men as can be organized, officered, and made use of in the fighting-line can be produced from the inexhaustible reservoir of the Russian Empire, and this human material is of magnificent quality. The results of the Russo-Japanese war are no guide to this quality, for there the previous training of the rank and file was defective. In the valor of ignorance, they despised their adversaries, and the staff and regimental officers were behind the times. That all this has been changed is shown by the progress made by the Russian attack on Germany's eastern frontier. Russia is only just beginning to use up the very fringe of her resources in able-bodied men with the colors.

As regards organization and mobilization, the Muscovite army has been a disappointment to its enemies; the extreme slowness of its mobilization was apparently reckoned upon by Germany as a prime and reliable factor, enabling the latter, with Austria-Hungary, to deal with France single-handed and demolish the resistance of the French force by quicker mobilization and superior strength, before

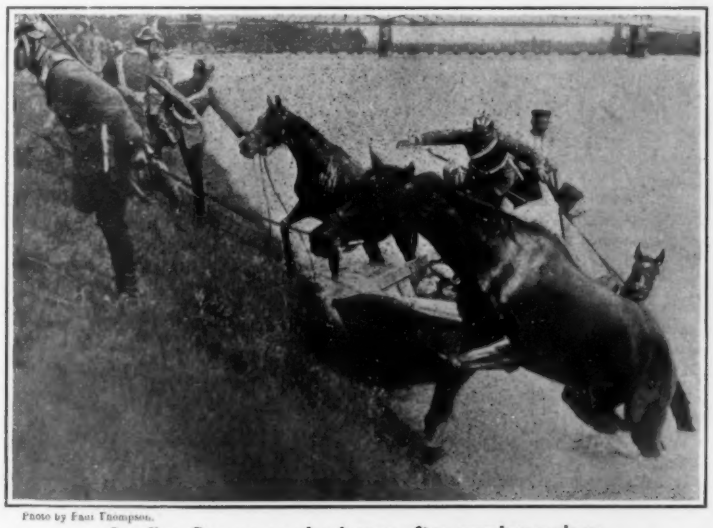


Photo by Paul Thompson.

Landing German cavalry horses after crossing a river.

Photo by Paul Thompson.

How the German cavalry crosses a river.

Copyright by Underwood & Underwood.

Austrian sharpshooters.

the Russian troops were in sufficient force to make their influence seriously felt on Germany's eastern frontier. This has turned out to be a miscalculation. The immense distances to be traveled by Russian troops mobilizing have been covered in a surprisingly short time; their advanced guards came into action at the very beginning of the campaign, and, thanks to the unforeseen check offered to the German advance by way of Belgium, the Russian menace had become a reality to be dealt with most effectively and immediately while the bulk of the German forces were still expending their strength in the endeavor to drive a wedge into the allied troops defending the French frontier. Judging from the Russian successes thus far against both Austrian and German adversaries, it would seem as if their training and general efficiency were equal to their spirit, which by all accounts is admirable, for this war, unlike the struggle with Japan, is notoriously a *popular* war, and the reported deficiency in skilled officers which has been attributed to the Russian army may turn out to be less serious than was supposed.

Belgium's Gallant Troops.

The Belgian army numbered 250,000 men when mobilized; their troops had done no fighting since 1815, and until the events of this campaign it would have been difficult to form any opinion of their efficiency, especially in field troops, though it was recognized that the government had done much to organize in defense of Belgian neutrality and the integrity of the national life, and those of us who have noted the change of conditions of service in their armed forces since 1906 and the earnest desire for efficiency given utterance to in such papers as the *Militaire Belge*, realized that the Belgian defense against Teuton aggression, which was foreshadowed by the building of strategic railways in Germany right up to the Belgian frontier in obvious preparation for the events which have now occurred, might be a very serious matter for the invaders. The result has more than justified this forecast; the Belgian army has fought splendidly and desperately. Not only has the defense of Liege covered the troops which took part in it with undying glory, but the Belgian forces have taken the offensive against the invaders, fought stubbornly in the open against odds, and retired only before overwhelming forces in order to make fresh efforts under more favorable conditions, in accordance with a plan of campaign worked out in conjunction with their allies.

From a military point of view, in the peculiar circumstances in which it came into play at the very outset of this gigantic campaign, it will probably be found that the efficiency of the Belgian army has been the pivot upon which the course of the operations has turned, since it must indutiably have upset all the calculations of the German strategists and given time for other factors to come into play.

Servia: The Cause of the Trouble.

The quality and efficiency of the Servian army was shown first in the Balkan campaign and confirmed in the resistance offered to the superior strength of the Austro-Hungarian troops in the fighting in the battles of the Drina River, when they routed an Austrian army of 110,000 men, of whom 25,000 were killed and wounded and 10,000 taken prisoners, together with 40 guns and large quantities of stores. The hearts of all ranks are in the fighting, the physique and condition of the men splendid, and the staff and regimental officers have profited by the lessons taught in the operations against Turkey, and they are keen and highly trained. The Servians are armed with the 7-millimeter Mauser rifle and Schneider-Canet artillery, and should be able to put about 450,000 men in the field.

The Kaiser's Spendid War Machine.

The German army is unquestionably a splendidly organized fighting machine, consisting of some 5,000,000 men on a war-footing, with a number of cavalry divisions. The infantry are armed with the Mauser rifle of 0.311 caliber, the field artillery with Krupp quick-firers, which are more numerous but considered inferior to the French and British field guns, and they have an ample supply of heavier guns and howitzers which have been brought into play during the present war with striking effect, notably at Charleroi. Their machine guns are also numerous and have done great execution. The gunners are well trained and have been ably assisted by aerial reconnaissance, but they have gained results by an immense expenditure of ammunition and superiority in the number rather than the quality of their field guns.

According to reports from eye-witnesses, many of the Krupp shells failed to explode. The efficiency of the heavy, long-range artillery, including howitzers, has been proved beyond a doubt. The German cavalry have made their influence felt in all directions in the present war on account of their great numbers; as horsemen and as horsemasters and scouts, they have not the reputation of cavalry in other armies, and the spectacular charges, knee to knee, in large bodies, which are carried out at German maneuvers against unbroken infantry, are likely to have hecatombs of dead horses and riders as their only result in war. In the charge of the German Guards Cavalry against the Twelfth British Infantry Brigade, for instance, the former were thrown back with great loss and in absolute disorder.

The infantry are remarkable for their steadiness and discipline in close formations, their drill is excellent, and in these same formations they have advanced upon the enemy in overwhelming masses, wave upon wave, with the utmost bravery and in spite of appalling sacrifices, the officers setting the example with admirable courage and devotion. Whether such reckless marching to destruction can be carried out later in the campaign remains to be seen. The German officer, efficient, well instructed, courageous, and proud of his profession, appears to rely upon a carefully organized, mechanical discipline and training, but the discipline is so hard and fast that it discourages individuality and initiative to a great extent and ignores the personal factor. They have great power of punishment on their men in peacetime, and rightly so, for they have to teach them much in a short time; but the natural tendency is to exalt the power of discipline at the expense of elasticity of training.

The German discipline has so far been maintained while the troops are acting on the offensive and know themselves to be superior in numbers and in weight of artillery to their immediate opponents. The German army has felt assured by its successes against the Danes, the Austrians in 1866, and the French in 1870-71, that its system was the best in the world, and so long as it kept up-to-date in arms and equipment, it would continue invincible. It seems to have underrated the opposition which could be offered by the troops of other nations armed with modern weapons, well organized and trained and fired with resolution to defend their country against aggression. So far, their military machine has apparently done all that could be expected of it. Their elaborate system of espionage appears to have given them ample information of things concrete, such as to arms, equipment, numbers, and dispositions of troops, but it could not inform them of the spirit in which their attacks would be met or of the action which various nations would take in opposition to their plans. Now that their forces have been checked, even if only temporarily, and the calculations of the General Staff have been upset, the army has still done all that is possible to make good the loss of precious time, and has struck formidable blows in further pursuance of its aggressive strategy, it remains to be seen how its organization will stand the pressure which will soon be applied relentlessly by its enemies on all sides, and how it will survive the ordeal of acting on the defensive.

There is one apparent weak point which is worth referring to with German organization—the food supply. The German soldier is not so constituted as to work on short rations; the General Staff seems to have counted upon feeding the troops by requisition during a presumably rapid advance through the enemy's country. Whether, when their time-table was upset and their forces were checked, they found it necessary to give priority to bringing up their heavy artillery and communication columns and supporting units, rather than food for those already at the front, it is impossible to say, but various accounts tend to prove that from the first the food supply has been precarious and insufficient, and German prisoners are said to have shown an equanimity and resignation to their fate as prisoners of war, which is not to be entirely accounted for by the relief felt by the average conscript on finding that he is "out of the hurly-burly," that he has done what his country required of him, and is not anxious to begin his experiences of active service in the field afresh.

The scarcity of food in the German armies is in sharp contrast with those of their opponents, whose troops appear, on the whole, to have been systematically well supplied.

One noticeable feature of the German organization which might be copied with advantage is the use of motorcars for the transport of machine guns. Both the Germans and the allies have made free use of motors for transporting infantry from place to place, in order to make good losses and reinforce threatened points, but the Germans, in addition, have succeeded in mounting their powerful 28-millimeter Krupp howitzers for motor transport, by arranging that the gun and its recoil mechanism shall travel on separate vehicles, each with its own motor power. Presumably it was this quality of transport which enabled them to bring these weapons into use against the forts at Namur; and the surprisingly short time in which they reduced some of the forts to ruins and were enabled to press on their advance, in spite of the resistance offered by the latter, may thus be accounted for in great measure. They have also provided themselves with an excellent equipment of portable searchlights for the illumination of the field of fire and the guarding of railway lines by night, which have been of great use.

Austria-Hungary's Military Resources.

The nominal strength of the Austro-Hungarian army on a war footing is 2,750,000 men; there are 210 batteries of field artillery, 56 howitzer batteries, 28 heavy howitzer batteries, and 45 mountain batteries, but the nominal strength is said to have been seriously reduced by desertions and by reservists failing to turn up on mobilization. In addition, the infantry are composed of many varying nationalities with little in common between them, in many cases not even language, so that, although its training is conducted more or less on German lines and by good officers, it is doubtful whether the army, which has not fought since 1866, will stand the crucial test of what is rapidly becoming a defensive war under depressing conditions. So far, the troops sent against Servia have signally failed in their mission, and have been withdrawn from that portion of the theater of war with great loss of men, guns, and prestige. As allies, the Austrians have, no doubt, enabled the Germans to concentrate their troops against the French at decisive points, and they have fought desperately in order to strike at the Russian position in Poland, and appear to have suffered heavy losses in the process without succeeding in stemming the tide of Muscovite invasion. Their infantry are armed with the 0.315 Mannlicher rifle, but the reports from that portion of the Continent in which they are fighting against the Russians are so meager and conflicting and give so little useful detail that it is impossible to judge of their efficiency or of that of the cavalry, who have, however, enjoyed the reputation of being excellent.

In conclusion, it may be said the data upon which to judge of the performances of the aircraft of any of the armies engaged in this war are at present quite insufficient. Aerial observation of artillery fire has undoubtedly been of advantage, notably to the Germans; but otherwise, beyond the fact that overhead reconnaissance, while freely carried out, does not seem to have affected the conduct of operations to any such extent as many critics expected it to do, it would be unsafe to generalize.

Some of the Tendencies of Eugenics

FROM the way that eugenics has been treated in the public prints, most people have the impression that it is a simple method of improving the human race which involves only the temporary inconvenience of a few sentimental persons who desire to pair off without regard to the principles of science; but much more is involved besides the matter of restricting marriage, and some of its far-reaching results may be inferred from remarks by Prof. William Bateson in his address on "Heredity" before the British Association at its Australian meeting, in which he says: "Everyone must have a preliminary sympathy with the aims of eugenists, both abroad and at home. Their efforts, at the least, are doing something to discover and spread truth as to the physiological structure of society. The spirit of such organizations, however, almost of necessity suffers from a bias toward the accepted and the ordinary, and if they had power, it would go hard with many ingredients of society that could be ill spared. I notice an ominous passage in which even Galton, the founder of eugenics, feeling, perhaps, some twinge of his Quaker ancestry, remarks that 'as the Bohemianism in the nature of our race is destined to perish, the sooner it goes the happier for mankind.' It is not the eugenists who will give us what Plato has called Divine releases from the common ways. If some fancier with the catholicity of Shakespeare would take us in hand, well and good; but I would not trust even Shakespeare's meeting as a committee. Let us remember that Beethoven's father was an habitual drunkard, and that his mother died of consumption. From the genealogy of the patriarchs also we learn—what may very well be the truth—that the fathers of such as dwell in tents, and of all such as handle the harp or organ, and the instructor of every artificer in brass and iron; the founders, that is to say, of the arts and sciences, came in direct descent from Cain, and not in the posterity of the irreproachable Seth, who is to us, as he probably was also in the narrow circle of his own contemporaries, what naturalists call a '*nomen nudum*.' Genetic research will make it possible for a nation to elect by what sort of beings it will be represented not very many generations hence, much as a farmer can decide whether his byres shall be full of Shorthorns or Herefords. It will be very surprising, indeed, if some nation does not make trial of this new power. They may make awful mistakes, but I think they will try. There are races who have shown themselves able at a word to throw off tradition and take into their service every power that science has yet offered them. Can we expect that they, when they see how to rid themselves of the ever-increasing weight of a defective population, will hesitate? The time cannot be far distant when both individuals and communities will begin to think in terms of biological fact, and it behooves those who lead scientific thought carefully to consider whither action should lead."

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Are Good Roads on Bridges Impossible?

To the Editor of the SCIENTIFIC AMERICAN:

Doubtless many people who observe and who have had occasion to use, particularly, the Williamsburg and Queensboro bridges in their automobiles, have noticed that the roads across them are almost continuously impassable. They are not only extremely rough and humpy, but torn up nearly all the time for the purpose of repairs, which, of course, causes constriction to the stream of traffic.

Considering that these structures cost the city tens of millions of dollars, it appears rather strange that roads of not even poor quality can be built and maintained on them.

I have often wondered whether the resources of road science have been exhausted on these important highways, and if not, why not. If said resources have been exhausted, undoubtedly some expert in Europe could solve the problem. A fee of a million dollars would not appear to be excessive for the city to pay him, considering the great investment that has been made in the supporting structure itself.

Since speaking of roads which are now being recognized as such important factors and upon which vast sums are spent, I have taken particular notice of the ultimate results produced by the use of oil as a dust layer.

I have seen the time when Long Island had a great many plain dirt roads which were as smooth as a wooden floor, but since oil has been used on them, they have become almost impassable, in that they are humpy. This is caused as follows: When it rains, water cannot penetrate except in certain places, usually where there is less oil, or in slight depressions where mud is formed. With the passing of vehicles, the dirt in solution is washed out, making the ruts deeper and deeper until the road is ruined.

I have thought that it might be well worth while for the State to experiment with a view to overcoming this difficulty. An addition of potash or caustic soda, which would slightly saponify the oil so as to permit the rain to penetrate more readily, would appear to counteract the destructive effect now caused by oil alone.

New York. ALBERT F. SHORE.

Lightning and the Automobile

To the Editor of the SCIENTIFIC AMERICAN:

I note on page 173 of the SCIENTIFIC AMERICAN SUPPLEMENT No. 2019 a short paragraph on safety during thunderstorms, which refers to a fallacy that a motorcar is one of the safest places in which to take refuge. Is it not about time that the conception that our standard insulating materials afford protection against lighting should be discarded? Of what value is the insulation provided by a number of inches of rubber when the potentials to be dealt with are of the order of millions of volts? Then again, a very appreciable shock can be obtained from a magneto through electrostatic capacity so small as to prevent the passage of a heavy lightning discharge. In other words, should a lightning discharge strike a motorcar, it is reasonably certain it would flash across the tires and not flow as does the current of the magneto in the case cited.

The value of any object as a "protection" against lightning lies not in its ability to provide a path of high insulating value, but to provide around the human body a *shunt* path of lower resistance than the body itself. Persons taking refuge under trees during a thunderstorm are struck because their bodies provide a path of lower resistance than an equivalent length of the tree-trunk; consequently, the lightning, following the path of least resistance, "side-flashes" to their bodies in preference to taking a direct course to earth.

As regards the motorcar: If a person should lie down in it or if it is provided with metal extensions, such as the supports of a canopy top which projected considerably above the occupants' heads, there would probably be little danger of death by lightning since a discharge striking the car would pursue its course to earth over the metal work, unless the latter was so light as to be immediately deflagrated, though it is quite likely that the occupants would receive severe shocks from the current charging the electrostatic capacity of their own bodies, as well as burns from the flash. On the other hand, if it were an open car with top down and the occupants' heads projected above the top of any metal work, it is not unlikely that they would receive a direct stroke, provided existing conditions predetermined the passage of a discharge in their immediate direction.

A little experimental work with electric discharges of some length, as produced in the laboratory, will speedily convince anyone of the truth of the above statements.

Wilmington, Del. L. A. DEBLOIS.

Pitching Baseball Curves

To the Editor of the SCIENTIFIC AMERICAN:

I was surprised to see, in a recent article in the SCIENTIFIC AMERICAN, a correspondent discrediting facts and theory in regard to pitching baseball curves. Evidently the correspondent, Irwin, and his professors are not acquainted with that admirable article, "The Dynamics of a Golf Ball," by Sir J. J. Thomson, in the SCIENTIFIC AMERICAN for February 11th, 1911. Or, if familiar with it, probably they doubt the truth of this great scientist's words.

Pronounced curves can be described by anyone by grasping a lath or yardstick in the middle and imparting a rapid twirl as the stick leaves the fingers. The correspondent says he failed to throw any curves; if he would practise with sticks, tennis balls, or ping-pong balls, I believe he will meet with success. When throwing a curve the ball leaves the thumb first and *rolls* off the fingers, hence the angular velocity will equal the linear velocity of the ball. That side which left the fingers will possess no relative motion to the air, therefore no extra pressure will be exerted against that side. On the opposite side the relative motion amounts to the sum of the velocity of the ball and the velocity of spin. Fig. 1 illustrates the relative motion of points on the surface of a ball whose velocity is 100 feet per second. The pressure on these points increases in like proportion, and as a result of the one-sided pressure the ball deviates; nothing could be simpler. Fig. 2 illustrates the reversal of Fig. 1. A ball or cylinder is placed under a stream of air or water; it will be forced out owing to the one-sided pressure.

According to the correspondent's words concerning Irwin's experiments, I am not surprised that he failed to find light on the subject. The body should not *fall* through a liquid of various densities, but should be

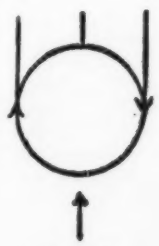


Fig. 1.

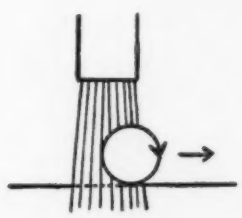


Fig. 2.

shot through horizontally. The body must be denser than any liquid used.

Facts and theory prove that parabolas and arcs of circles can be described by throwing bodies having different properties. The velocity of a baseball and the velocity of spin are practically constant throughout short flights, hence an arc of a circle is described. The velocity of a stick or ping-pong ball and the velocity of spin are rapidly retarded and a parabola is described. If the body could remain in the air until the angular velocity was zero, it would assume a straight-line course.

I have never seen "serpentines" or "floating corkscrews" described with a baseball. In order to produce such a curve, the ball must rapidly rotate in a plane at right angles to the direction of flight. It is not impossible to impart this rotation with the hand, but it is of such a low order that no perceptible deviation occurs.

The erratic and unerratic behavior of twirling balls after bouncing is easily explained. Two forces act on a twirling ball while in flight and at the instant of bouncing: the force of linear velocity and the gyroscopic force of rotation. In different balls these forces will be differently related, depending on their construction. It is an everyday occurrence to see a tennis ball bounce erratically; it is done purposely and unintentionally on the court. But a baseball is seldom seen to bounce erratically for this reason: a baseball seldom acquires a gyroscopic force exceeding its bouncing force, and hence will bounce in the expected direction. The gyroscopic force of a tennis ball far exceeds its bouncing force, hence bounces in obedience to this force. On the other hand, I have seen heavily fouled baseballs, on striking ground, dart off in an unexpected direction, the heavy blow from the bat imparting sufficient gyroscopic force to the ball as to exceed the bouncing force.

Monticello, Ind. RUSSELL B. CLAPPER.

"Suspending Life"

To the Editor of the SCIENTIFIC AMERICAN:

Anent the article under the above title in your issue of August 15th, I desire briefly to consider the third paragraph. The writer, M. Becquerel, is too well known to have his standing as a scientist questioned, and his brilliant experiments are not only classical, but of the highest importance. But his conclusions concerning life are such as many sense-bound scientists, who are not philosophers, are prone to reach. Because, in his experiments, under the abnormal conditions of low temperature and vacuum the vital *activity* of an organism stops, or disappears, it does not follow that life has been annihilated. Observation here is necessarily limited to physical phenomena, as in science generally. It would be as logical to say, when a weaver stops his loom because of excessive heat, or cold (as in the experiments referred to), or when he goes to lunch (the vacuum (?) condition), that the weaver is dead. So far as his activity is observable in the evolution of his product, as a rug, garment, etc., there is absolute suspension, or, what corresponds to life, viz., weaving, in the illustration, is dead. But of course on resumption of work by the weaver, the weaving goes on as before the suspension.

Dr. Becquerel, with other scientists like him, ignores *a priori* knowledge, or what is directly and positively known by experience, and depends solely on the knowledge of inference, through observation and the senses. But the latter is trustworthy only for the phenomena of matter.

Life, which may be provisionally defined as the organizing faculty of mind, is of an order of being not discernible through the senses, and of course cannot be seen, measured, or weighed.

When Dr. Becquerel or anyone else has demonstrated that the directive impulse which evolves a frog from one germinal cell and a man from another is found and defined in the constitution of matter, or in the reactions of chemistry, there may be some ground for assuming that life is nothing more than an imaginary entity, and not until then.

It may be added that the experiments of Dr. Becquerel from a scientific standpoint, are not crucial, for the reason that the conditions of temperature and vacuum imposed on the organisms are not absolute, but merely extreme or approximate. It has not yet been determined what would be the conduct of matter of any kind at absolute zero of temperature and in absolute vacuum.

W. H. HOWARD,
Of the Examining Corps, U. S. Patent Office.

Washington, D. C.

The Fallacy of Eternal Youth

To the Editor of the SCIENTIFIC AMERICAN:

A quarter century has passed since Brown-Sequard launched a goat's lymph theory of everlasting life. So it is with those who have moistened their lips by a new sensation, after the inconveniences and pains and aches of age set in; they look about for a "Fountain of Youth," or becoming reconciled to the inevitable, seek by fair or foul means some sort of intercourse with the nether world.

There are topics beyond human understanding, and many theories must be taken upon faith. We cannot explain why and how we entered upon the units of this world we live in, and we cannot explain where and how we are leaving it, save by faith, and the belief in the teachings of those best qualified to advance satisfactory dogmas. Have any of these comprehended fathomless space? Our five senses carry to the brain a few mathematical facts of scientific research, yet we continue to seek, until we must eventually round up at a standstill. In a limited world, there is a limited investigation. The lower animals live their lives, guided by instinct. Man only recently is beginning to know what the birds have known of the air since time immemorial. The study of air rivers, air eddies, calms, storms, electric, etc., is being worked out by aviators. Why not employ more instinct and less scientific investigation, where the seeming impossible is to be surmounted? The conscience of man is an instinct. The conscience rules the higher ego, the appetites the baser ego. Those who have studied conscience, believe that the simplest life we can lead proves the happiest, which goes to show that pseudo ambition is harmful. Napoleon died young, but observe the denizen of a Sahara. In his life-long quiet way of getting close to nature is he not sure of his threescore and ten?

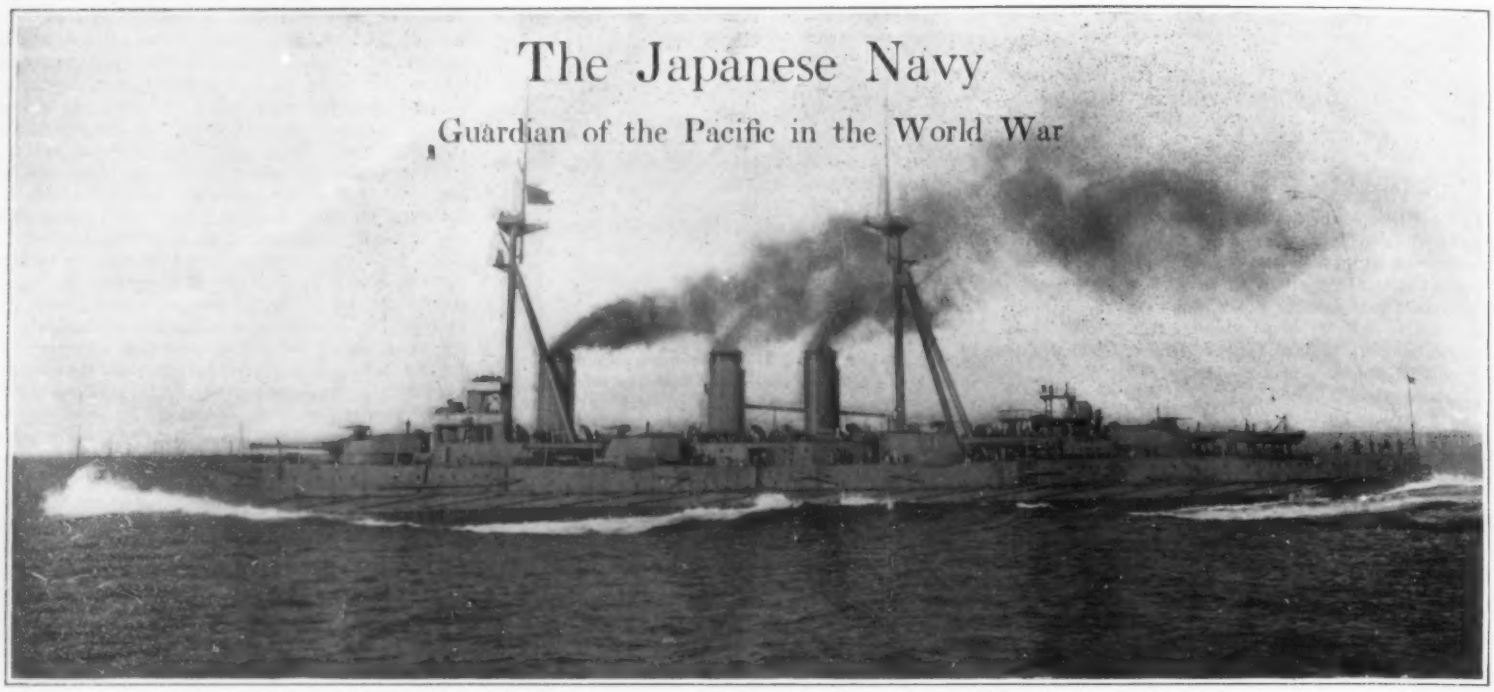
It is plausible to prolong the life of a cell by bathing it in its life-giving pabulum, or by supplying a new cell element at its molecular death. It is possible to preserve a building, by substituting a brick, a stone, a door, or a window for the disintegrated unit, but what an exhausting, troublesome method, when the old structure can so easily be demolished in its entirety, and a new and beautiful one reared in its place. Man's life is continued by his progeny, until it is ordained that man can no longer inhabit this sphere of the universe. With each geological era, a new creature held sway, and then quietly passed into oblivion. Therefore, there is no logic in assuming that the creature man has arrived to stay.

J. A. GUTHRIE.

Portsmouth, Va.

The Japanese Navy

Guardian of the Pacific in the World War



Date, 1912. **Tons,** 21,500. **Speed,** 20 knots. **Guns,** twelve 12-inch, ten 6-inch, eight 4.7-inch. **Torpedo tubes,** five. **Belt armor,** 12-inch.

Dreadnought "Kawachi"; also "Settsu."

IN estimating the strength and efficiency of the Japanese navy, it is well to make a distinction between the ships which were built previously to the Russo-Japanese war and those built in the ten years which have intervened since that struggle. The fleet possessed by Japan at the opening of the war was thoroughly modern and represented, both in its battleships, cruisers, and destroyers, the latest practice of the British and French naval architects who were responsible for the design of the Japanese ships.

The Japanese war material was good and it was well handled; for it was the common judgment of naval experts the world over that the natural aptitude of the Japanese race for the sea showed itself in the skill and daring with which their fleets were maneuvered and fought in the various operations of the war.

It was one of the remarkable features of that struggle that the Japanese navy emerged from the conflict stronger in *materiel* than it was when the war began. This was due to Japanese valor and skill in the battle-line and Japanese ingenuity in salvage operations conducted on the sunken Russian fleet in Port Arthur.

With all the experience of the war to guide them, it was to be expected that the new battleships and cruisers built by the Japanese since the struggle should be greatly superior to the older vessels; and so well have the Japanese expended the funds available for new construction, that, in spite of the enormous financial burden laid upon them by the war, the Japanese navy holds to-day the fifth position among the great navies of the world.

The close of the war found the Japanese in possession of eight battleships; and of these four, the "Fugi," "Asahi," "Shikishima," and "Mikasa" were ships which had passed through the naval campaign and survived its perils. The other four, the "Iwami," "Hizen," "Sagami," and "Suwo," had been captured from the Russians.

Of these eight ships, the least valuable to-day is the "Fugi," built at Ellswick in 1896. She carries four 40-caliber 12-inch and ten 50-caliber 6-inch guns, and is protected by a belt of 18-inch Harveyized armor. Her present speed is probably about 16 or 17 knots, and her displacement 12,300 tons. The "Asahi" and "Shikishima," also veterans of the war, were built in 1901 and 1900 in England. They carry four 12-inch, 40-caliber guns, and fourteen 40-caliber 6-inch guns, and are protected by a belt of 9-inch Harveyized armor. Their displacement is 15,200 tons. The present speed is about 18½ knots. In common with the "Fugi," each ship carries five torpedo tubes. The "Mikasa" will be recognized as Admiral Togo's flagship during the war. She is of 15,200 tons displacement and mounts four 12-inch 45-caliber and fourteen 45-caliber 6-inch guns, and is protected by a 9-inch belt of Krupp armor. Her speed is about 18½ knots. Built in 1900, she was accidentally blown up in 1905, but was raised and thoroughly reconstructed. She is to-day a serviceable ship of the pre-dreadnought type.

Of the other four battleships, the "Iwami," a French-built battleship of the "Czarevitch" class, is of 13,600 tons displacement and 18 knots speed. She mounts four 45-caliber 12-inch and six 45-caliber 8-inch guns, and is protected by a belt of 7½-inch Krupp armor, besides having internal armor as a protection against torpedoes. The "Hizen" is of particular interest to Americans, because it was built at Cramp's in 1902. She was torpedoed at Port Arthur, repaired, and then severely punished in the sortie in August from Port Arthur, where she was subsequently scuttled and then raised by the Japanese and remodeled. She is of 12,700 tons, 18½ knots speed, and mounts four 40-caliber 12-inch and twelve 45-caliber 6-inch guns. She is protected by a belt of 9 inches of Krupp armor.

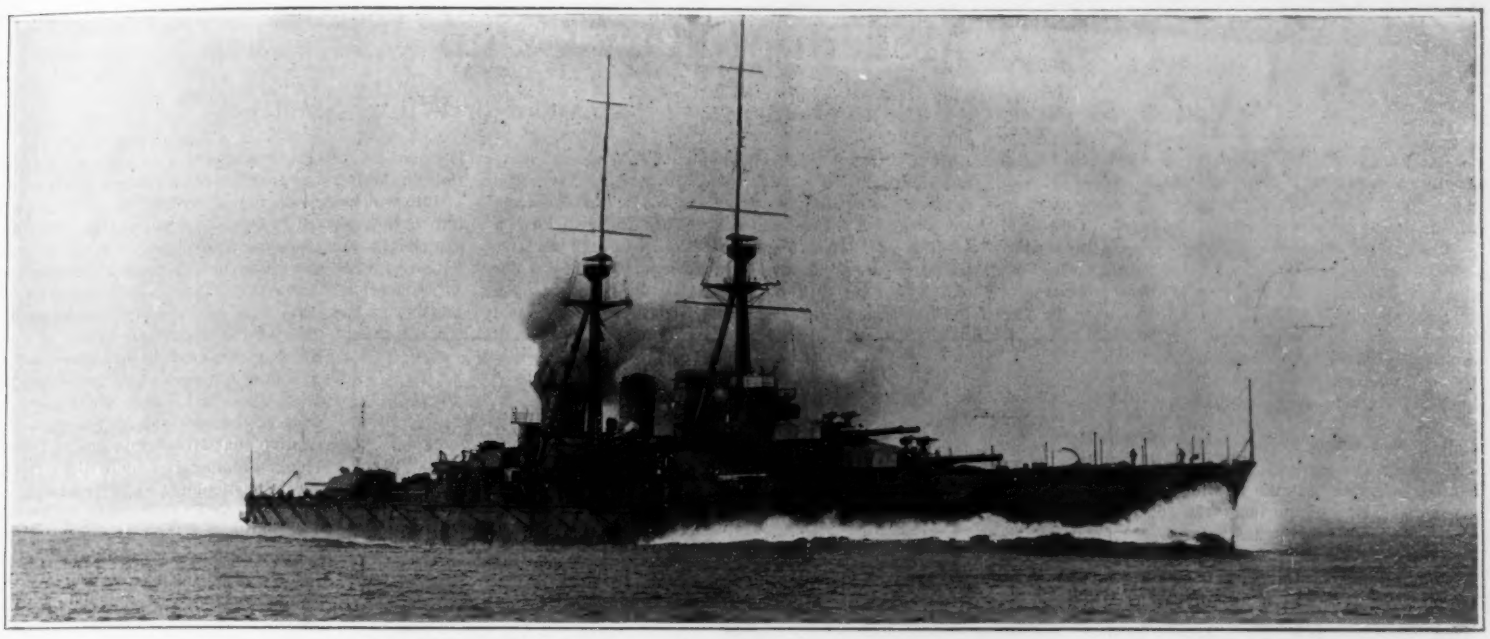
The remaining two battleships of the eight, the "Sagami" and "Suwo," were built at the Baltic works in 1901-1902. They are of 13,500 tons and 18½ knots speed, and they mount four 45-caliber 10-inch and ten 45-caliber 6-inch guns, and are protected by a 9-inch belt.

Japan possesses a homogeneous fleet of nine armored cruisers, all of which took a very active part in the operations of the Russo-Japanese war. In protection, gun fire, and speed they are very similar; and it is a remarkable fact that Admiral Togo did not hesitate, at times, to place them in the first line of battle. The "Nisshin" and "Kasuga," completed in 1904, and purchased from the Italians, are of 7,750 tons displacement and mount four 45-caliber 8-inch and fourteen 45-caliber 6-inch guns, and are protected by a belt of 6-inch armor. Their speed is about 19 knots. The "Aso," captured from the Russians, was built in France. She is of 7,800 tons and 22 knots speed, and mounts two 45-caliber

Drawn by Oscar Parkes

Date, 1915. **Tons,** 30,500. **Speed,** 22½ knots. **Guns,** twelve 14-inch, sixteen 6-inch. **Torpedo tubes,** six. **Belt armor,** 12-inch, 9-inch and 8-inch.

Dreadnought "Fuso"; also "B," "C," and "D."



Date, 1913. **Tons,** 27,500. **Speed,** 28 knots. **Guns,** eight 14-inch, sixteen 6-inch. **Torpedo tubes,** eight. **Belt armor,** 10-inch.

Battle-cruiser "Kongo"; also "Hi-yei," "Haruna," and "Kirishima."

8-inch and eight 45-caliber 6-inch guns, and is protected by an 8-inch belt. The six armored cruisers, the "Idzumo," "Iwate," "Aguma," "Yakumo," "Asama," and "Tokiwa" are of about 9,800 tons displacement and 20 to 21 knots speed. They are protected by a 7-inch belt and mount four 40-caliber 8-inch guns and fourteen 40-caliber 6-inch guns.

Since the war Japan has ceased the construction of armored cruisers.

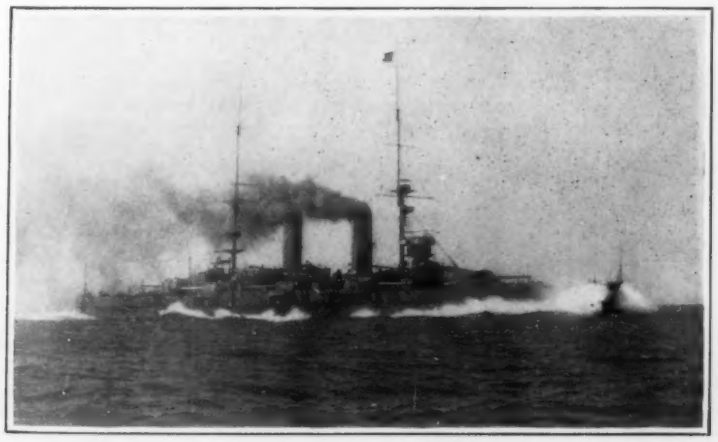
Japan possesses some fine scout-cruisers, the best of which are the three vessels "Hirato," "Yahagi," and "Chikuma," of 5,000 tons and 26 knots speed, mounting six 6-inch 50-caliber guns, and protected by a 3-inch deck. These were completed in 1912. A somewhat older scout is the "Tone," of 4,100 tons and 23 knots speed, mounting two 50-caliber 6-inch and twelve 50-caliber 4.7-inch guns, and protected by a 3-inch deck. These last-named four vessels were built in Japan. The fleet also includes eight second-class cruisers of from 3,000 to 6,500 tons displacement and from 21 to 23 knots speed. These include the "Soya," built at Cramp's, sunk at Chemulpo during the war, and subsequently raised and refitted. Her trial speed was 24½ knots, and she mounts twelve 45-caliber 6-inch guns. Another historically interesting vessel is the "Tsugaru," of 6,630 tons, carrying eight 6-inch guns and having a speed of 18 knots, which was sunk at Port Arthur and subsequently salved and reconstructed. Belonging to the pre-bellum period are nine smaller gunboats and cruisers of from 1,200 to 4,200 tons.

The Japanese have paid special attention to their destroyer fleet, which numbers fifty-two boats, with two under construction. The fleet is modern, dating from 1900 to 1914, the largest batch of thirty-seven boats having been completed in 1908. The naval list includes fifty-five torpedo boats, and fifteen submarines, with two building. The two under construction are of the "Schneider" type and they are to have a surface speed of 17.5 knots and a speed submerged of 9 knots. The boats of the "Vickers" type have a speed of 13 knots on the surface and 8 knots submerged.

The new navy of Japan, dating from the war, consists of large, swift, and heavily-armed ships in which are embodied the experience gained during that conflict. The first battleships to be added (in 1906) were two English-built vessels, the "Kashima" and "Katori," of 16,400 and 16,000 tons displacement, respectively. They mount four 45-caliber 12-inch, four 45-caliber 10-inch, and twelve 45-caliber 6-inch guns, and are protected by a 9-inch belt. The presence of the four 10-inch guns entitles these to be placed in the semi-dreadnought class.

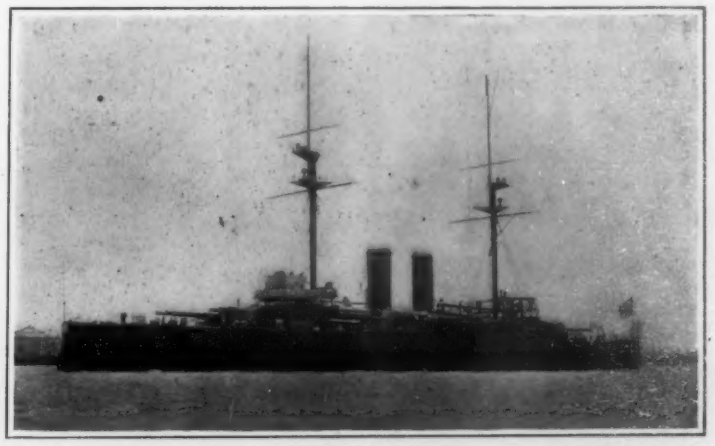
Following these ships come two unique vessels which might be called semi-battle-cruisers, the "Tsukuba" and "Ikoma," of 13,766 tons displacement and 20½ knots speed. They mount four 45-caliber 12-inch, twelve

(*Concluded on page 390.*)



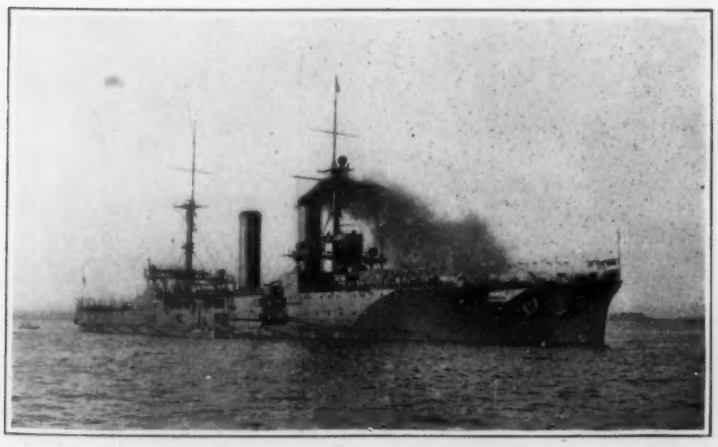
Date, 1910. **Tons,** 19,500. **Speed,** 18.5 knots. **Guns,** four 12-inch, twelve 10-inch. **Torpedo tubes,** five. **Belt armor,** 9-inch.

Semi-dreadnought "Satsuma."



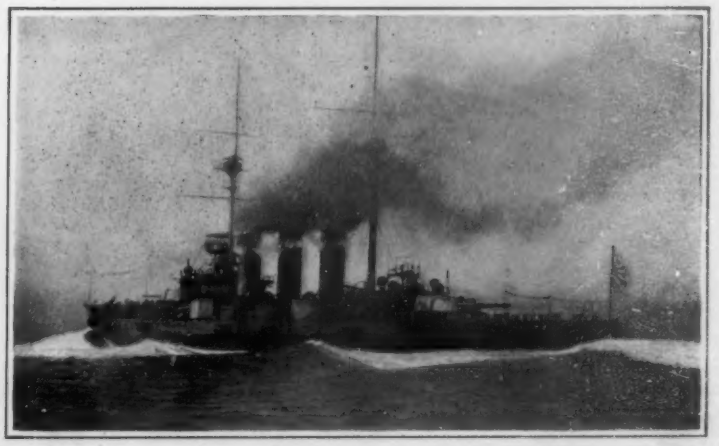
Date, 1906. **Tons,** 16,000. **Speed,** 20 knots. **Guns,** four 12-inch, four 10-inch, twelve, 6-inch. **Torpedo tubes,** five. **Belt armor,** 9-inch.

Semi-dreadnought "Katori"; also "Kashima."



Date, 1907. **Tons,** 13,766. **Speed,** 20.5 knots. **Guns,** four 12-inch, twelve 6-inch, twelve 4.7-inch. **Torpedo tubes,** three. **Belt armor,** 7-inch.

Semi-battle-cruiser "Tsukuba"; also "Ikoma."



Date, 1910. **Tons,** 14,600. **Speed,** 22 knots. **Guns,** four 12-inch, eight 8-inch, fourteen 4.7-inch. **Torpedo tubes,** three. **Belt armor,** 7-inch.

Semi-battle-cruiser "Ibuki"; also "Kurama."

A Modern Military Camp

Various Methods of Building Temporary, Permanent or Winter Shelters

A MODERN military camp is far more substantial in character, far more ingeniously planned than the layman realizes. It may be only temporary, in which case it is constructed by the troops in the field themselves, or it may be of a fairly permanent character, in which case it may be built both by soldiers and civilians under the guidance of the engineer corps, or as they are known in Europe "pioneers." The simplest of all camps are those which are used simply for bivouacking, and the most elaborate are those in which huts and barracks are used in order to provide some measure of protection against the weather.

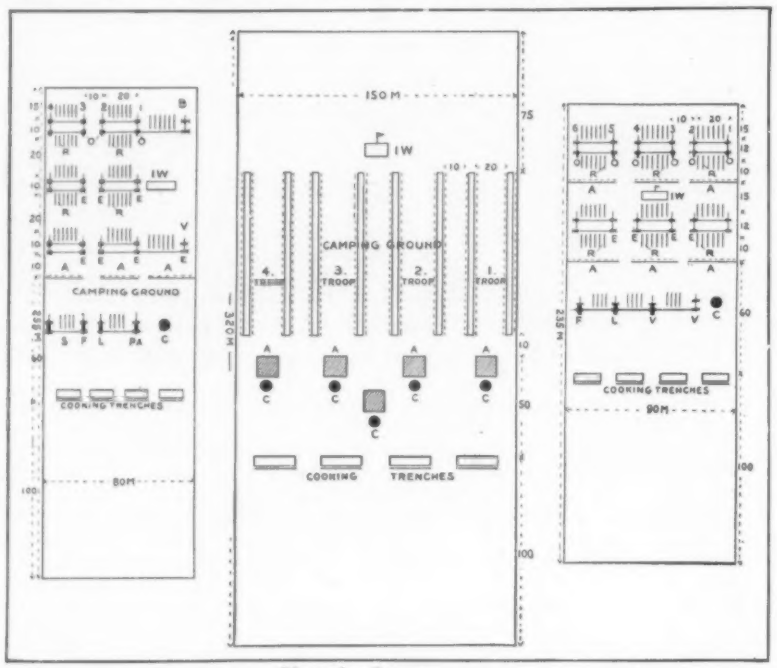
Obviously the most useful protection against weather is the well-known army tent. In erecting tents, the general direction of the wind prevailing about a camp is ascertained, and the tents are pitched in lines parallel with the wind's travel. In order to shield the troops from wet and cold soil, a wooden floor is ordinarily provided, the necessary material being found either on the camping ground itself or being carried along from the last camp.

Circular wind screens, surrounded by a ditch, are to be found in many military camps as a protection against storms. These screens are built by driving in piles to a height of three feet, the piles being connected by ropes of straw or grass. Against this straw, branches or the like are piled so as to make a wall, which is held in place by a layer of earth at its foot (Fig. 1). If long poles can be obtained and much covering straw, panels from seven to eight feet can be tied together and supported by poles, as a protection against the wind (Fig. 2).

Camp huts are most easily made by tilting two wind screens against each other in the manner shown in Fig. 2, the angle at the ridge being 90 degrees. Assuming that the height of the ridge from the ground is 9 feet 4 inches, the interior will have a breadth of 16 feet 5 inches, or room enough for two rows of cots and an aisle a yard broad. The beams are of the type shown in Fig. 6. Boards may be laid upon the beams and covered with tar paper. One gable end is closed and the other provided with a door. In order to keep the hut dry, draining ditches are dug all around it, into which the rain flows. Around the bottom of the hut earth is packed so as to keep out drafts. Such huts are usually not less than 20 feet long (with accommodations for 20 men) and not more than 33 feet long (with accommodations for 32 men). The cots may be built in at the same time as the huts themselves. In the Austro-Hungarian army a round hut of straw (Fig. 3) has been adopted.

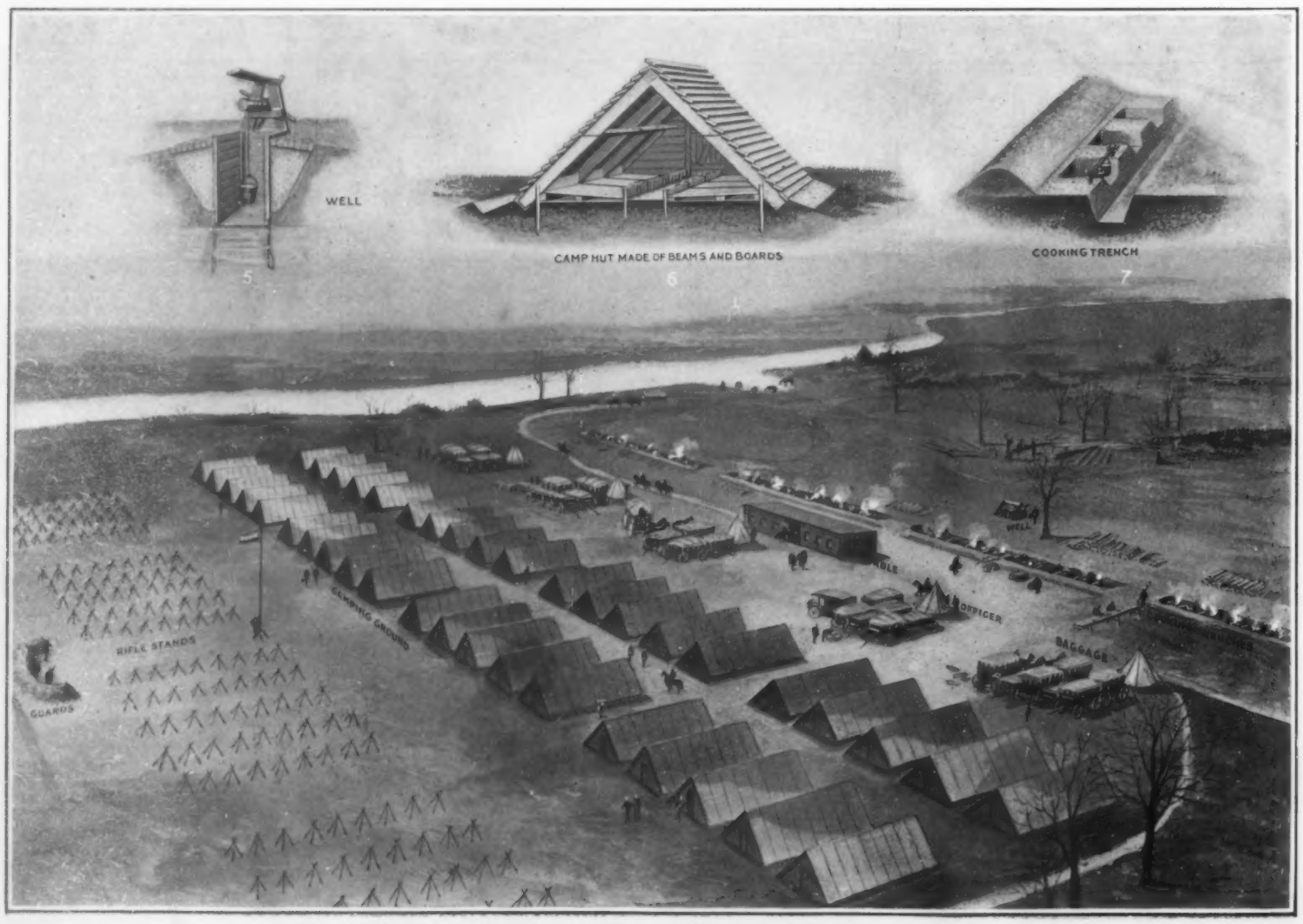
Winter huts are of various types, but their construction is much the same as that of the ordinary hut, with the exception that stronger beams and heavy sloping roofing is employed. The latter is particularly necessary because a layer of earth overlies the entire roof. Such huts are built in an excavation not more than 2½ feet deep on suitable beams. An iron stove serves to heat the interior, or a stove made of bricks, turf, or the like. If stove piping cannot be readily obtained, old vegetable and meat cans are fashioned into a pipe. When the hut is built in a deeper excavation, a sloping roof is employed as shown in Fig. 4, composed of several layers of earth and wood. This heavy roofing is necessary to protect the men within the hut from shell and shrapnel fire.

Instead of huts, barracks may be constructed with vertical side walls. They are built with buried posts or stanchions. Joists or joined boards may be used for the posts. The walls are boarded up both from without and within, and the hollow space between is filled with turf, moss, earth, and the like, as a protection against heat or cold. Window openings may be provided as may appear necessary. In winter the



Plan of a German camp.

A, baggage and equipment. *B*, sentry. *C*, officers. *E*, ammunition caissons. *F*, fodder. *L*, provisions. *IW*, guards. *O*, guns. *PA*, baggage wagons. *R*, stalls. *S*, blacksmiths. *V*, supplies.



General view of a German military camp.

The small views above illustrate the construction of a well (Fig. 5), a permanent camp hut of wood (Fig. 6), and the cooking arrangements (Fig. 7).

entire structure is jacketed with earth up to the gable walls. Stables may be joined to the barracks. They are either of the sloping roof or the gable roof type and are big enough to house horses, the attendants to the horses, as well as harness, fodder, and the like.

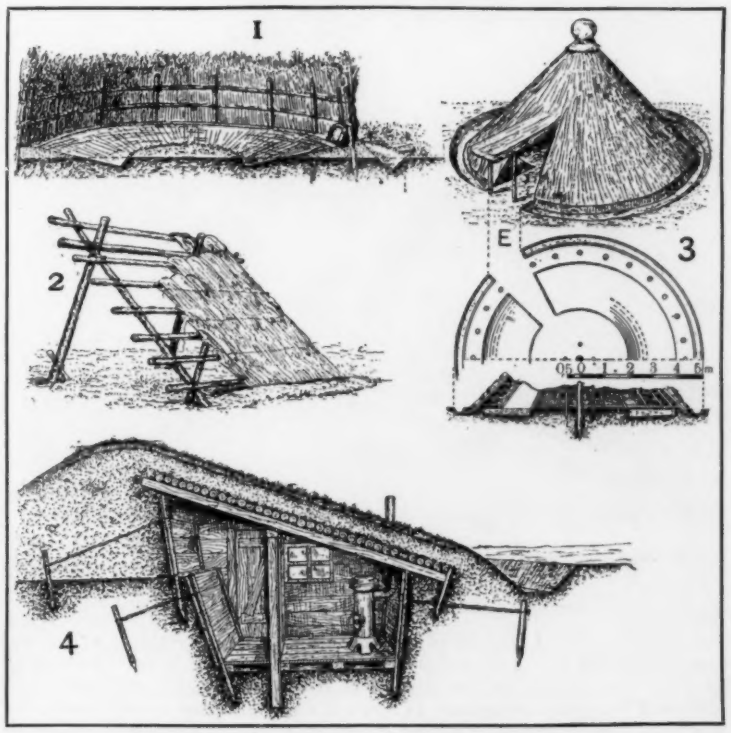
For cooking, trenches 1½ to 2 feet in depth and 3¼ feet wide at the top are used. In one side wall five holes are dug, as shown in Fig. 7. The excavated earth is thrown up in front to form a windshield. If there are no buildings near containing kitchens which can be used, hearths are built of brick or of limestone and lime mortar. Three masons can build such a hearth in one day with six hundred bricks and cover the whole with a protective roof. For a single company (squadron or battery) three caldrons of 175 quarts capacity each will be required.

Field ovens can be built if necessary by the field bakery column, in order to provide the troops with bread. For this purpose the iron framing which the field bakery column always carries with it is employed. Mortar, sand, and bricks must be obtained on the spot. In the Prussian army the iron framing of the oven is built in with the brick and cannot be removed except by breaking the masonry away. In other armies it may serve simply as false work to be removed after the oven is completed; but in this case it is harder to build the oven. The hearth is always first constructed, with an easy rise toward the rear. Stone, sand, etc., are used in the foundation, and a vault of brick completes the masonry. At the rear end a chimney is built and at the forward end draft holes and other convenient openings are provided. A protecting roof covers the hole. The oven is completely protected by clay, stones, gravel and the like.

The water supply of a camp is a matter of great importance. Only running water is used. In the German army the upstream water is used for drinking purposes, and the down stream water for watering horses and for bathing. Suitable signs notify the men which water is safe to drink and which may be used only for bathing. In shallow or narrow streams, basins are dug or small dams built so as to form a reservoir of ample dimensions. Stepping stones are provided to keep the water clean, as well as board protection to prevent the banks from crumbling. Basins are dug for watering horses; troughs are provided only in case of necessity, and are then propped on posts and filled by means of pumps. Pipes may be driven if water lies at a reasonable depth, in other words not more than 20 feet. Depending upon their size, these pipes will deliver from 4 to 22 gallons of water per minute. If water lies very near the surface a hole is dug and a cask, the bottom of which has been knocked out, is placed in the hole to form a basin. If the water lies at a greater depth, the basin may be formed of box sections, driven in one on top of the other, in position (Fig. 5). If the depth is greater than 3 meters, a kind of shaft must be made, the wooden sections being driven in one after the other, the opening at the top being greater than that at the bottom. The water is then raised by means of a suction pump.

Photograph by Branger.

A German military camp at Visé.



Examples of structures used in permanent camps.

Fig. 1.—Screens for protection against wind. Fig. 2.—Another style of wind screen, that can be converted into a shelter. Fig. 3.—Elevation and plan of round straw hut, adopted by the Austrians. Fig. 4.—Sunken winter hut, usually constructed in intrenchments. (Illustrations from *Handbuch für Heer und Flotte.*)

Random Reflections

By Our London Correspondent

I'VE been reading von Bernhardi's book "Germany and the Next War" and have been much interested in the way it is written. As is usual with German books, a philosophical introduction precedes the really business-like section, but with Bernhardi the philosophy strikes me as exceedingly perfunctory. It is so obvious that in writing it he is merely conforming to one of the Fatherland's traditions; that awful German tradition governing the construction of books. In my time I have browsed gently in one or two philosophic pasture lands, finding the food, as a rule, a little thin and not quite adapted to my particular digestive apparatus, although occasionally, by judicious nibbling, one gets a little nourishment; but never before have I tried to make a meal off such shockingly poor fare as Bernhardi serves up in his first two chapters.

He calls them "The Right to Make War" and "The Duty to Make War." It is not necessary to say much about these chapters; there can be but few people in the United States who would trouble to read long arguments having such titles. After all, except from curiosity and if I had nothing else to do, I wouldn't read a long proof that twice two is five or that the earth is flat. As Huxley once remarked, one doesn't reach years of discretion without definitely deciding that some things are not worth examining. But there are little touches of unconscious humor about Bernhardi which help the bored traveler along the stony labyrinths of his argument. At the bottom of page 53, for instance, he makes the handsome admission: "War is not always the final judgment of Heaven."

The rest of the book seems to be written with more gusto; he leaves the realm of theory for that more interesting and congenial region, the region of partial facts. He is a great man on numbers: number of men, number of guns, number of horses, number of ships, and extent of territory. He knows the relative fighting powers of all nations reckoned in "men put in the field"; he arranges his figures and draws conclusions. He seems to me to have left something out; he nowhere estimates the relative fighting power of different ideals. I cannot help thinking that what a man fights for has something to do with the way he fights. Would a German, fighting to impress his superior culture on that barbarous nation, the French, fight quite as hard as a Frenchman fighting to preserve his home inviolate, to keep his passionately loved France a nation, to prevent a repetition of the horror and humiliation of 1870? Surely the passion to proselytize the missionary fervor never reaches quite such heights as these. And then those low-class mercenaries called English soldiers and sailors—well, they seemed to think, in their uneducated way, that Kaiser Bill is trying to rule the roost and, knowing nothing of the advantages of the German culture, they object. They object quite strongly; so strongly that it is doubtful whether anything like an equal number of German missionaries could ever persuade them.

I really think that sort of thing matters. Of course, one must have a rifle. Well, Bernhardi knows how many rifles everybody has got. Having your rifle, it is useful to be able to point it approximately in the direction of the thing you want to hit; a fact which has apparently been a little overlooked in the German army; but also the spirit in which the man with the rifle pulls the trigger must have some bearing on the result.

The fact is that Bernhardi is a German military theorist and is tremendously in love with the German military machine. One can understand this. Any big, efficient machine is attractive. Marine engineers and central station engineers often have a positive affection for the machines under their control. To some extent this explains the invasion of Belgium. To respect the neutrality of Belgium would be to impair the efficiency of the German war machine. In a way, it offends one's artistic sensibilities. Here is a scheme, an ingenious, perfected, finished scheme, a beautifully symmetrical, artistic whole, and you ask me to ruin the whole thing by leaving out a part of it!

It is the fault of specialization all the world over. One's sense of proportion becomes distorted. Nothing matters very much except one's own particular job. This indifference and exclusiveness is very marked in scientific men, not only where the arts are concerned, but even where other branches of science are involved. I knew an old professor of physics who used to refer to "botany and the other occult sciences." Bernhardi has come to think that the German war machine is the most interesting and important thing in the world, not because he is a wicked German, but merely because he is a human being who has specialized on the German war machine. There are plenty of people just as ill-balanced, only their mental center of gravity happens to be situated elsewhere: Christian Science; writing novels; astronomy; or should women have the vote. A specialist is useful when one wants information about his particular pet subject, but when he endeavors to define the relations of his subject to other subjects, he generally makes a bad mess of it. They are all a little like the Cambridge senior wrangler who was asked what he thought of Milton's "Paradise Lost." He said he liked it in a way, but he couldn't see what the author was trying to prove.

Germany is a specialist on a big scale and has all the specialist's faults on a big scale. Its errors, quite naturally, are also on a big scale. The invasion of Belgium was very fit and proper from the point of view of the military specialist, but a horrible blunder from the point of view of everybody else. I hope this example will make specialists more humble, but I doubt it. They are a proud and stiff-necked race. But in future, instead of wilting under a sense of inferiority, I, for one, in presence of the specialist's complacent serenity, will watch, with perhaps a faint stirring of pleasurable anticipation in my degenerate heart, for the premonitory symptoms which indicate that once again a specialist has come a fearful cropper.

Cellulose Sponges

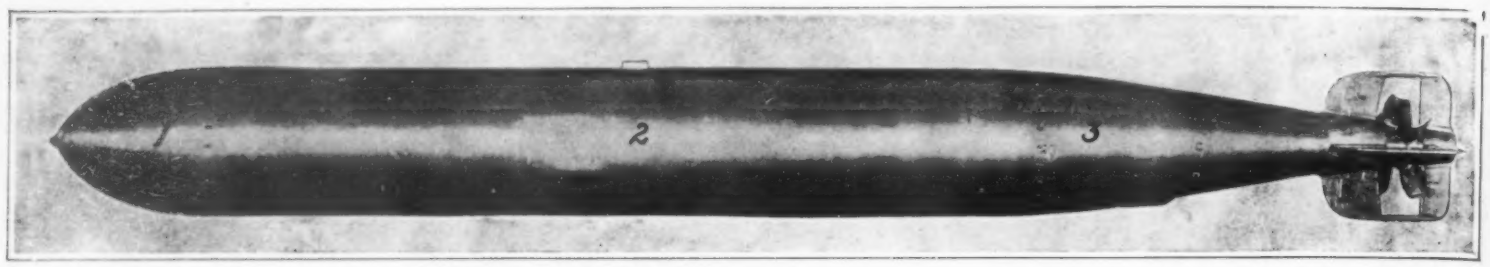
RUBBER sponges as a substitute for the natural article have long been known. Now we are to have them made from a product of cellulose called "viskose," which ought to make them considerably cheaper. Viskose is the xanthogen acid ester of cellulose, and the process is thus described in *Umschau:*

The viskose is stirred up with an aqueous solution of caustic soda into a homogeneous fluid. This is allowed to stand for several days (the so-called ripening of the viskose) and kneaded with strands of hemp cut into finger-lengths to form a "fiber dough." Into this are evenly stirred crystals of Glauber's salts. The size of the crystals corresponds to the size of the pores desired in the finished sponge. This dough is then shaped into round or oval pieces of suitable dimensions.

Finally, the sponges are immersed in water, which dissolves the crystals of Glauber's salts, leaving the corresponding pores. The whole process consumes some six weeks.

Torpedo Warfare

Description of the Mechanism by Which the Torpedo is Driven Unerringly to Its Mark



One of the latest types of the Bliss-Leavitt torpedoes, showing the three separate sections of the torpedo in their assembled condition ready for service.

IN the present stage of its development there are three methods by which the automobile torpedo is started on its destructive flight. First, it may be discharged through the side of a battleship or cruiser at a depth of from twelve to fifteen feet below the surface of the water from a tube contained within the hull of the vessel; second, it may be discharged from a launching tube mounted on the deck of a destroyer; and third, it may be discharged from the nose of a submarine.

It is the secrecy and invisibility of torpedo attack which invests it with such deadly moral and physical effect, and for this reason submarine torpedo attack is far more effective, both in its ability to get home upon the enemy and in its disconcerting effect upon the morale, than when it is delivered from a battleship or cruiser, or from the swift torpedo boat or destroyer. Broadly speaking, the torpedo tube fitted in the larger ships can be brought into use only in the later phases of a hard-fought engagement, when the enemy's gunfire has been silenced or greatly reduced, and his ships have been so badly cut up that they have lost their maneuvering power, and it is possible for the enemy to draw in within easy torpedo range. Destroyer attack will generally be carried out at night or in thick weather, or when the enemy's line has been broken up and his ships are more or less crippled and the rapid-fire batteries silenced. Attack by submarine, however, can be successfully carried out at any time of the day or night; and the records of the present war show how successful such attacks may be.

The object of all torpedo warfare is to detonate a heavy charge of high explosive against the submerged portion of the hull of a ship, and with such damage that the enemy will either be sent to the bottom or will be so seriously crippled as to be incapable of successful maneuvering. The ideally perfect means of attack would be a man-controlled submarine carrying an enormous charge of explosive in its nose, and possessed of sufficient speed to enable it to overtake the enemy and explode that charge unerringly at a carefully selected point on the hull of the ship, preferably abreast of the magazine. Attempts have been made to develop such a weapon; but thus far they have been defeated, first, by the impossibility of building a submarine of sufficient speed to accomplish this result; and second, by the fact that the detonation of such a large charge would mean the inevitable destruction of the submarine itself.

In the present state of the art the work of delivering the vital blow against the ship is entrusted to an automatic, self-controlled, miniature submarine, known as the torpedo. The place of the quartermaster or his equivalent, who in the submarine attends to the steering in the vertical and horizontal planes, is taken by a wonderfully ingenious and effective automatic steering mechanism, which, if it be properly adjusted, will carry the torpedo at an initial speed of 40 knots unerringly to the mark through a distance of from 7,000 to 10,000 yards. The British claim to have developed their own submarines to a point at which they will do accurate shooting at the last-named distance. Obviously, the chances of error are increased in proportion to the distance from the mark, and hence it is always the aim in torpedo attack to get as near as possible to the enemy before the torepdo is launched. It is in this respect, in addition to its invisibility, that the submarine is the beau-ideal torpedo vessel; and in the recent attack by German submarines, in which a single blow has been sufficient to send the enemy to the bottom, it is probable that the submarine crept up, unseen, so close to the victim that it was practically impossible to miss the mark.

Discharge of a torpedo from a launching tube on the deck of a destroyer.

Note the air exhaust from the tail of the torpedo.

We present three illustrations showing the external appearance, the internal mechanism, and the method of launching from a destroyer, of one of the latest submarines in existence; the type used in our own navy and known as the 21-inch Bliss-Leavitt torpedo. The torpedo consists, essentially, of a charge of 250 pounds of guncotton carried in the head, as shown in one of the illustrations, an air tank containing the motive power in the shape of a charge of highly compressed air, an engine for propulsion, and vertical and horizontal rudders for steering in the horizontal and vertical planes, with automatic means for controlling these rudders. With this general description in mind, let us follow, in detail, the longitudinal section which shows very clearly interior construction of one of these really wonderful machines. The "war head" or nose of the automobile contains a guncotton charge of 250 pounds. Normally a safety pin *G* prevents the movement of a plunger or striking rod *P*. Before the automobile is loaded into its tube, the pin *G* is removed and the plunger, or trigger, is in position to strike and fire the detonating charge *D* which extends axially through the guncotton charge. Immediately back of the guncotton is the air tank *B* filled with air at high pressure. A pipe leads through a reducing valve to the turbine engine, which through a shaft *E*, drives the two propellers *I, I*, in opposite directions.

Immediately back of the air tank is what used to be known as the "secret chamber"; and for many a decade in the earlier history of the torpedo the secrets of this chamber were successfully concealed. It contains the mechanism for maintaining the torpedo at the desired depth of about fifteen feet below the surface of the water. This it does by controlling the horizontal rudders at the tail of the torpedo. Immediately at the back of the secret chamber is a narrow compartment perforated on its outside wall to allow the water to enter and exert a hydrostatic pressure due to the depth of the torpedo below the surface of the water.

The rear wall of the secret chamber carries a piston valve *K* which is capable of movement in the direction of the axis of the torpedo. The rear wall is watertight and flexible, and the pressure of the water upon it, tending to drive it inward, is resisted by coil springs, as shown at *K*. At a certain predetermined depth, according to the tension of the spring, the spring and the water pressure will be in equilibrium; below that depth the piston valve will be driven in by the water pressure, and above it, the spring will push the piston backward. To prevent a too sudden fluctuation in this action, the piston is connected to the rod of a swinging pendulum *H*. The motion of the piston valve due to this varying hydrostatic

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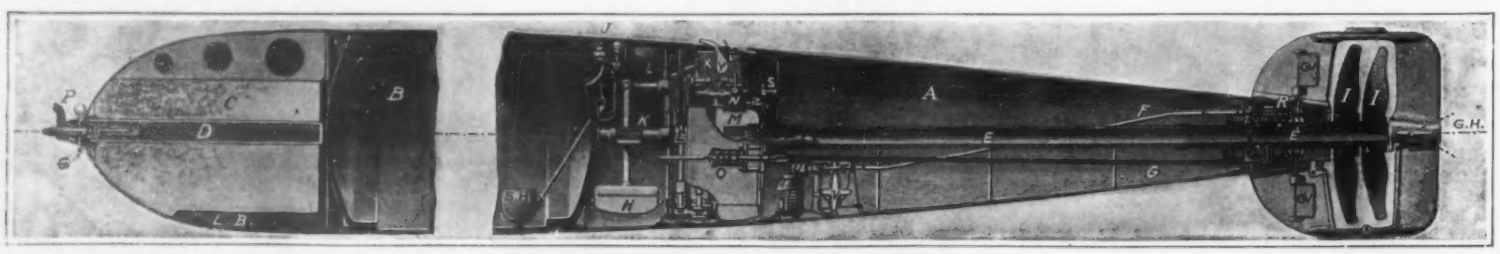


A longitudinal section through a Bliss-Leavitt torpedo, showing the disposition of the explosive, the driving machinery, and the propellers.

P, plunger or striking rod. *G*, safety-pin. *C*, guncotton charge. *D*, detonating charge. *B*, air-flask. *J*, charging valve. *K*, hydrostatic valve. *H*, pendulum. *M*, turbine. *N*, submergence control mechanism. *S*, submergence valve. *S H*, superheater. *X*, valve case. *Y*, air lever. *O*, immersion servo-motor. *L*, pressure regulator. *V*, gyroscope. *T*, gyroscope impulse. *U*, servo-motor. *G, V*, rudders for horizontal control. *G, H*, rudders for vertical control. *F* and *G*, rudder controls. *E E*, propeller shaft. *I, I*, propellers. *R*, shaft bearing. *A*, afterbody. *L, B*, ballast.

THE INTERNAL MECHANISM OF THE LATEST TYPE OF TORPEDO

War the Destroyer

The Chances of Death in Battle and from Other Causes

By Alfred J. Lotka

THE word *chance* conveys to the untrained mind the idea of something beyond the pale of natural law, something which obeys no rule and defies all measure and prediction. Diametrically opposed to this is the conception which the mathematician and the statistician has of chance. To him the very criterion of chance events is that they follow certain definite laws. The statistics collected by a life insurance company enable the actuarian to foretell with much precision the toll that death will exact in a year among the body of insured. It is said that large engineering firms of long experience can predict very closely the number of human lives that a given construction will cost. In war, too, laws of chance are operative, though here, we have not the same wealth of data based on actual observation from which to draw our conclusions, and furthermore, conditions are so widely different in different wars and may change so extensively in the interval between the successive wars, that predictions are necessarily uncertain. Of course, when the requisite data of a problem of chances in war are given, there is no difficulty in drawing the logical conclusions. As an example, consider an army of 250,000 men, who engage in battle with a loss of 50,000 killed and wounded. Suppose the gaps in the ranks to be refilled by re-enforcements, and the army, now once more 250,000 strong, to fight a second battle, and so on, the casualties being at each battle 50,000, which are made up by fresh troops before the next encounter. Suppose five such battles to be fought. What are the chances that a man in the original army of 250,000 shall fight through and survive all the five battles?

The answer is not hard to find. The chances of survival unhurt after the first battle are evidently 200,000/250,000, or 4/5.

In the second battle 200,000 men of the original army are fighting, and if we suppose casualties to be evenly divided among the original men and the fresh troops, then again ⅘ of the former, i. e., 160,000, will come out of the battle unhurt. Similarly, at the third battle ⅘ of 160,000, or 128,000, survive in condition to engage for a fourth time. Of these another ⅘, or 102,400, enter the fifth battle, and lastly 81,920 escape from injury in the fifth battle. There were in all 250,000 men in the original army, hence the chance that any one of them will survive five battles with the casualties and re-enforcements as indicated are 81,920 : 250,000, or 0.32768 : 1.

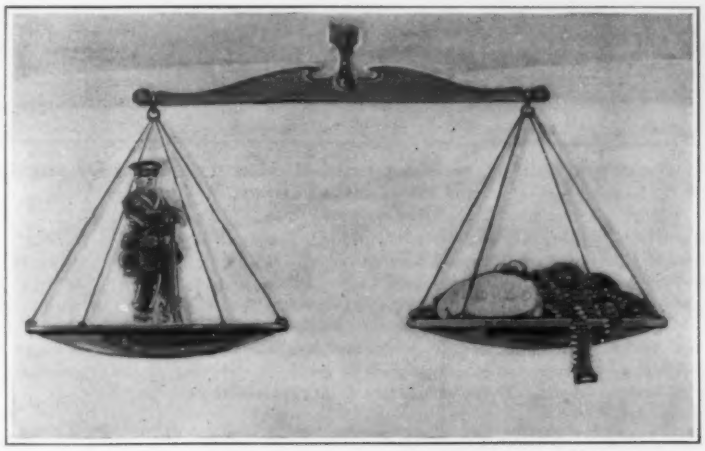
If the reader is mathematically inclined, he may amuse himself by proving that the probability of a given soldier of the original army being put out of action in n battles is

$$P = \frac{1}{5}\left\{1 + \frac{4}{5} + \left(\frac{4}{5}\right)^2 + \left(\frac{4}{5}\right)^3 + \ldots + \left(\frac{4}{5}\right)^n\right\}$$

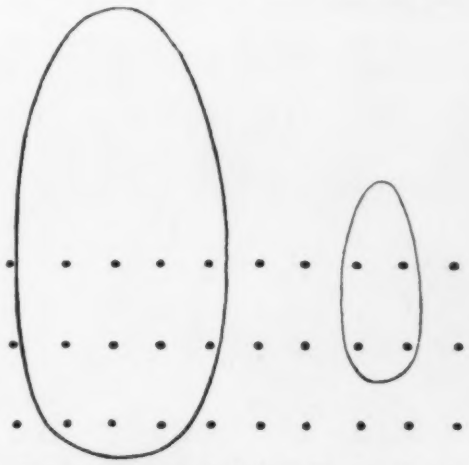
$$= \frac{1}{5}\left\{\frac{1 - \left(\frac{4}{5}\right)^{n+1}}{1 - \frac{4}{5}}\right\} = 1 - \left(\frac{4}{5}\right)^{n+1}$$

One conclusion from this formula is, that it would take an infinite number of battles to put out of action all the men of the original army (i. e., to make the probability of a given one being killed or wounded equal to unity). This, of course, disregards deaths from disease or old age, which would have reaped in the last man long before the infinite series of battles had been fought out.

And disease is more to be feared in war than are bullet and shell. In the Crimean war, out of every one thousand of French troops 236 died by disease and only 64 from wounds. Among the English troops the corresponding figures were 179 and 47. Napoleon in the march to Moscow lost two thirds of his army, though he fought only one general engagement. The Russian armies operating against him lost, in the course of five months, four fifths of their strength. The losses of the Federal armies in the civil war in two years amounted to 53.2 deaths in the thousand, of which only 8.6 were caused by wounds, the remainder, 44.6, by sickness. In the Franco-Prussian war the losses of the Germans were 34.7 per thousand from wounds, and only 30 per thousand from sickness. This is explained partly by the shortness of the campaign (seven months) and partly by the fact that the Germans were greatly superior in numbers and were able to send their sick home. In the Russo-Japanese war the ratio of deaths by sickness to deaths from wounds was three to one among the Russians and two to one among the Japanese. As for the present war in Europe, Sir William Osler has made the following observations:



The cost of killing. In the Russo-Japanese war 70 pounds of gold and 1,053 bullets were spent per man killed.



The paradox of the bad shot. The fire of poor marksmen may be more effective than that of sharpshooters.

"I think this war will set a new record for low mortality among the wounded. Formerly, with the best first aid and hospital work, a mortality record of five or six per cent of those who reached the base hospitals was considered creditable. Up to date there has been but one fatality out of more than seven hundred wounded who have reached the base hospital at Oxford. This death was caused by tetanus.

"This result is partly due to the self-sterilization of the modern high velocity bullets and partly to efficient field first aid. I have yet to see a wound by either a dum-dum or an explosive bullet.

"If the experience of the past counts for anything, the expeditionary force on the Continent has more to fear from the bacilli of typhoid fever than from bullets or bayonets. In the Boer war bacilli accounted for 14,000 of the 22,000 lives lost.

"All fighting forces should take advantage of the knowledge that the human body can be protected from typhoid fever by vaccination. The success of this measure in the armies of the United States and France is proof enough. I do not fear that typhoid fever will break out in the camps in England, but this is not so in the large areas of the Continental theater of war.

"And then, with the coming of winter, the prevention of pneumonia will be a problem. It cannot be prevented like dysentery by the conscientious boiling of all the water drunk. Many people carry pneumonia germs with them, which are harmless as long as a soldier is in good condition, but which make their way to the lungs when the resisting powers of the body are lowered by exposure incident upon long marches and hard fighting in cold and rain."

The question is often discussed whether modern war is more deadly than the wars of the past. The supposition that the progress of modern military science is rendering war more and more deadly is contradicted by the fact that in the Franco-Prussian war 365 bullets were fired for every Frenchman killed, while in the Russo-Japanese war the corresponding figure was 1,053.

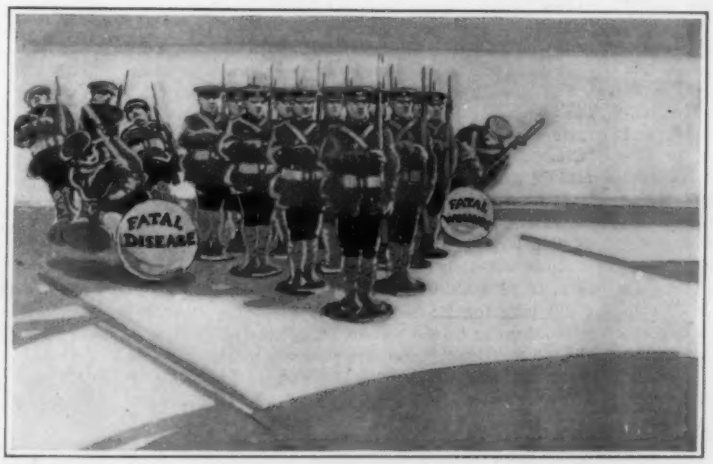
The fact is that progress in the art of killing is always surpassed by progress in the art of defense. "The result is," says Gen. Percin, "that the ratio of men killed or wounded in actual battle is continually diminishing. This ratio was 6 per cent under Frederick the Great, 3 per cent under Napoleon, 2 per cent in 1870 and ½ per cent in Manchuria."

The result of this increased efficiency of defense, is to increase the "cost of killing." Thus it has been estimated that in the Russo-Turkish War (1877-1878) the cost of one human life was $15,000; in the Russo-Japanese war it was $20,400. In the Franco-Prussian war the cost was exceptionally high, viz., $21,000. This is due to the small number of great battles.

Closely related to the subject of the cost of killing is that of the effectiveness of gun-fire. A group of shots fired at a target will spread in a more or less regular manner about the *center of impact*, which, if the firearm is correctly built and the range rightly estimated, should correspond to the point aimed at. The shots spread around this center owing to a number of causes, among them inequalities in the ammunition and errors of the gun. The principal cause of dispersion, however, is inaccuracy of aim on the part of the marksman. The appended table shows the dispersion of average shots at different ranges:

TABLE OF DISPERSION—AVERAGE SHOTS.

Range.	Mean.		
	Vertical.	Lateral.	Longitudinal.
Yards.	Feet.	Feet.	Yards.
100	1.07	0.97	308.64
200	2.03	1.77	398.21
300	2.87	2.41	348.79
400	3.59	2.90	282.04
500	4.21	2.26	219.91
600	4.88	3.75	185.37
700	5.62	4.40	156.66
800	6.44	5.23	135.28
900	7.33	6.21	118.57
1000	8.29	7.37	105.89
1500	14.50	11.98	76.00
2000	22.71	18.76	64.00



The bacillus is mightier than the bullet. In the Crimean war, out of every sixteen men one died of wounds and four of disease.

The phenomenon of dispersion gives rise

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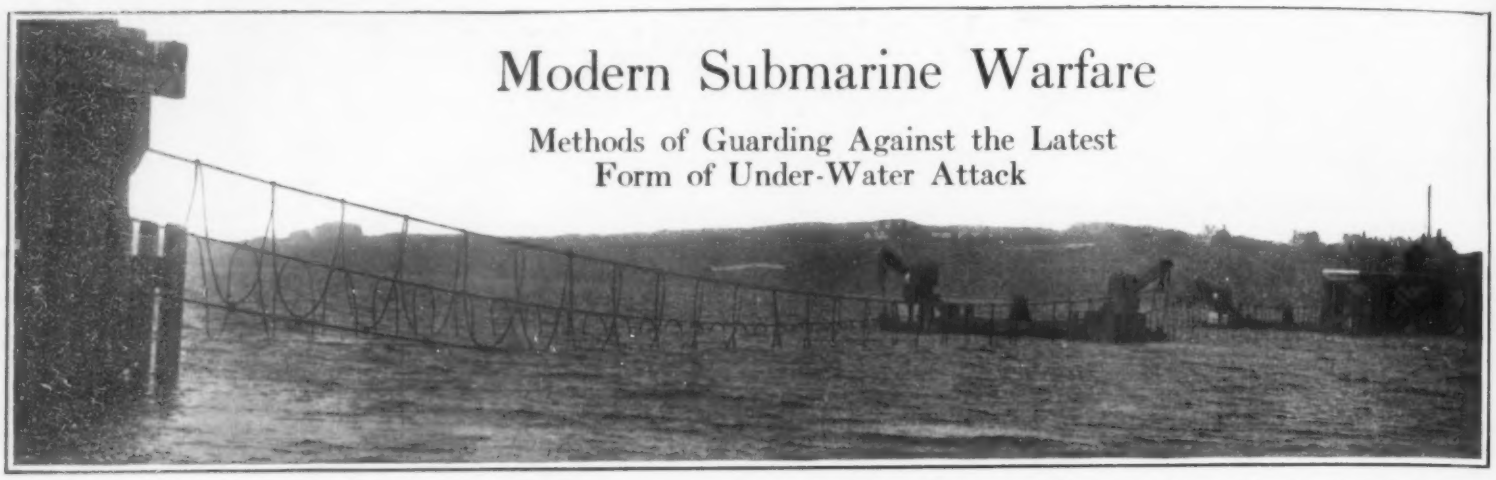
Modern Submarine Warfare

Methods of Guarding Against the Latest Form of Under-Water Attack



Defenses at entrance to a British harbor, consisting of pairs of heavy superimposed cables, looped together with lighter cables. Their object is to prevent the passage of submarines.

A STUDY of the history of naval and military attack and defense shows that every new means of attack has been met by a more or less effective form of defense. Thus, in the past half century of naval warfare, the ever-increasing power of the gun has been met by a fairly commensurate improvement in armor, the iron plating of the French ships in the Crimean war being followed, successively, by the compound plates of steel and iron, the homogeneous all steel plate, the Harveyized plate with its carbonized surface, and lastly, the gas-hardened Krupp plate with the various later improvements of the Krupp system. The Whitehead torpedo carried on the swift torpedo boat found its answer in the high-velocity rapid-fire rifle and in the more minute sub-division of the hull of the warship. Bomb-dropping from aeroplanes and airships has its answer in high-angle rifle fire and in the covering of the magazines and other vulnerable portions of the ship by screens of horizontal armor.

The latest, and in certain conditions of warfare, the most deadly means of attack, the submarine, still awaits an effective answer, as the recent successful exploits of the German submarine flotilla have most conclusively proved.

Submarine the Weapon of the Weaker Power.

Long before the present war, it had been recognized that the submarine was essentially the weapon of the weaker power, and therefore of what might be called the offensive-defense. Ten years ago, when the speed, range, and sea-keeping qualities of the submarine were very limited, it was considered that its rôle would be confined to harbor defense, and that, even in this restricted sphere, its value would be moral rather than material. That is to say, the dread of unseen attack would at once prevent a close blockade by the enemy and would have a wearing-down effect on the morale of the officers and men.

So rapid has been the development of the past decade, that the largest of the German submarines has a displacement of 800 tons, a surface speed of about 17 knots, a speed submerged of about 10 knots, and a theoretical radius of action on the surface of 3,000 to 3,500 miles. One of the United States submarines has remained submerged, with the crew aboard, for twenty-four hours; and, in the opinion of our submarine officers, it would be possible, by the use of chemical purification of the air and by drawing on the air supply of the submerging and trimming tanks, for one of our submarines to remain submerged for several days.

The living quarters of the largest vessels are sufficiently commodious for a fair degree of comfort, and the cooking, washing, and toilet refuse can be discharged in diluted form by force-pumps. The range of the submarine is limited not so much to the capacity of the fuel tanks as by the endurance of the crew. If the weather is fine and the submarine can proceed, undetected, at the surface, the cruise might extend to one or two thousand miles, without a return to port. In surface cruising in rough weather, the watch is continually drenched, and the lack of means to dry the clothing and other discomforts would render an earlier return to port a physical necessity.

The information which has come through regarding the naval operations in the North Sea, gives reason to believe that the German submarines, in their search for their quarry, have made cruises of several hundred miles; for, moreover, they have been reported as operating off the English and even the Scottish coasts. Their principal cruising ground, however, is off their own coasts, where they go out and lay in wait for the cruisers and destroyers which are steaming to and fro off the mouths of the Elbe, the Weser, and the Ems. A probable plan of operations is for a submarine flotilla to pass out at night to selected positions on the enemy's patrol routes, submerge and await the coming of the enemy. If the submarine is discovered, it can "go to sleep" on the bottom until the search for its whereabouts has been given up. It is reported that the loss of the three British cruisers of the "Cressy" class was brought about by the co-operation of a scouting Zeppelin with the submarine which made the attack.

Defense Against the Submarine.

So far, no single effective means of defense, such as that of armor against the gun and the gun against the destroyer, has been devised against the submarine. Protection must be sought in the co-operation of several precautions, which, in their aggregate effect, should afford, and doubtless are affording, a fair measure of security. Among these may be mentioned: Thorough sub-division of the hull; interior armor; a careful look-out from the ships and by aeroplane scouts; a high cruising speed and frequent changes of course; instant ramming by destroyers; and the rapid-fire gun. The above defenses are effective if the fleet is under way. If the fleet is at anchor in a roadstead or harbor, protection may be afforded against the submarine by mine-fields, heavy chain cable entanglements and netting.

This photograph shows a torpedo caught by its propeller in a battleship torpedo net.

Protection by Sub-division.

The best protection against the submarine, so far as the absolute loss of a ship is concerned, is a thorough system of sub-division. Large ships such as the "Cressy," "Hogue," and "Aboukir," which went down rapidly after being torpedoed, were of an older type, built at a date when sub-division, judged by present-day ideas, was comparatively limited. In later ships of the largest size, such as battleships and battle-cruisers, sub-division has been made so minute, that it is believed a ship of the type of our "Pennsylvania" could take the blows of two or even three torpedoes, without going to the bottom. The pre-dreadnoughts of the "Connecticut" class have over five hundred separate watertight compartments, big and little, below the protective deck.

Protection by Armor.

Of late years great attention has been given to the question of working into the hull a certain amount of longitudinal armor, for the purpose of meeting the force of the torpedo explosive on the outer skin, or of confining its effects to the outer portion of the hull and preserving intact the vitals. Thus, the flagship of the British fleet, the "Iron Duke," is generally credited with having thin armor extending below the main belt down to the bilges, this armor being applied externally. A more common method is to run a longitudinal wall of armor about two inches in thickness, along the inner side of the series of torpedo compartments, near the outer skin, with which all capital ships are provided. The main object of such armor is to protect the magazines, which, if they be reached by the shock and heat of the torpedo explosion, are liable to be set off and the ship instantly and absolutely destroyed. This effect is shown very dramatically on the colored cover of the present issue.

Protection by a Careful Lookout.

In calm weather it is surprising at what a distance the periscope of a submarine can be detected by a good look-out. In rough weather, however, it is difficult to make out even the wash of the periscope until the submarine is within point blank range. Experimental work done by our army aviators has proved that in clear and calm weather it is possible to detect a submarine even at a considerable depth, when the aviator flies at a height, say, of about 2,000 feet. In rough water it is more difficult so to detect the submarine, although, if it were running with its periscope exposed, a hydro-aeroplane searching around a ship that was steaming slowly on patrol duty would probably detect the approach of the enemy in time for the cruiser to make a change of course.

Had the "Cressy" and her two sisters each carried an aerial scout, the disaster, possibly, might have been prevented.

Protection by Ramming and the Rapid-fire Gun.

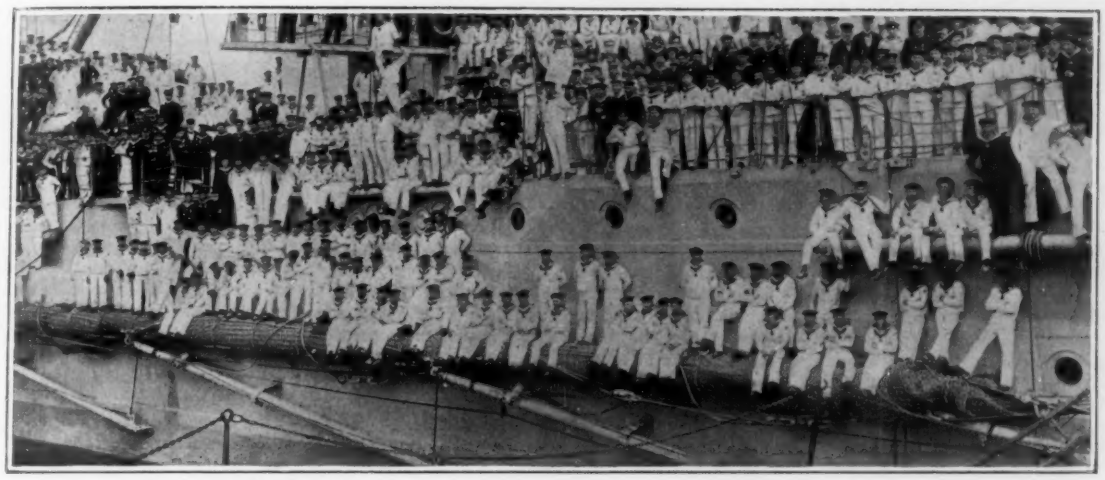
The tactics used when an attack is expected are for the scouts and destroyers to attempt to sink the submarine by putting on full speed and making a rush for its periscope in the hope of hitting that, or even the hull itself. If the submarine were ever so lightly touched by the sharp forefoot of a destroyer running at high speed, it would be ruptured and the vessel sunk; also if the periscope were struck and broken off or bent, there would probably be heavy leakage around the stuffing boxes, and disablement would follow.

We have heard a good deal during the war of the sinking of submarines by concentrated rapid fire from the torpedo-defense guns; but the periscope offers so small a mark, that we doubt if any vessel has been sunk in this way.

Protection by High Speed and Change of Course.

Although the surface speed of the latest submarines runs from 15 to 17 knots, this speed is not available during attack. A submarine must submerge, and in the submerged condition the speed is only from, say, seven to nine, or perhaps ten knots. The best protection, therefore, for a patrolling fleet, is never to let the speed drop below about fifteen knots; for where there is a difference of five knots in speed, the submarine's only chance of getting within range will come when it finds itself in or near the course of a hostile ship that is bearing down upon it. Hence, for self-protection, cruisers on patrol or scout duty should not only maintain a good rate of speed, but they should make a frequent change of course.

A great naval campaign, such as that which is being carried on between the British and German fleets, can be brought to a decisive conclusion only when the



View at bow of "Moltke" (sister to "Goeben"), showing crew seated on torpedo net, which is rolled up against side of ship.

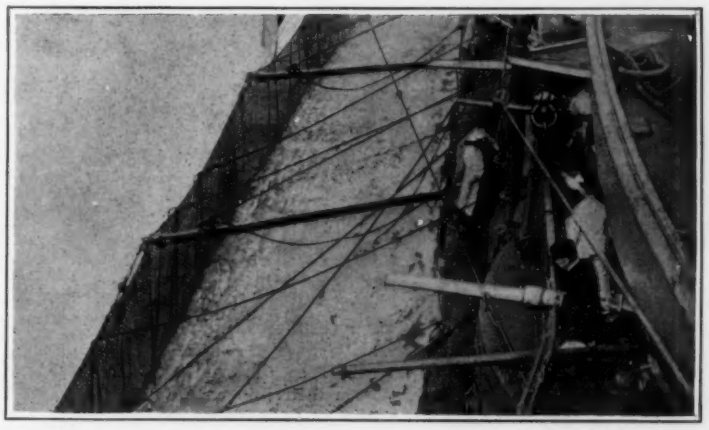
battleship fleets have met and fought it out in a general engagement.

As we have already shown in previous issues, the German fleet being greatly inferior in strength, has taken position in its various harbors and roadsteads, the entrances to which are blocked by mine-fields, by heavy booms, and by netting and cables. Behind this protection, the ships themselves are safeguarded by torpedo netting, which is boomed out from the vessel, and extends like a curtain for nearly the full depth of the hull.

Torpedo Booms and Netting.

We present several illustrations showing the methods by which a harbor with its contained fleet may be rendered secure against the insidious attacks of the submarines. No submarine of the standard type would attempt to pass through a mine-field, particularly if the mines were anchored at varying depths, as shown in our illustration. Contact with one or other of the mines, either by a direct blow or by becoming entangled in the cables, would be inevitable if an attempt were made to break through.

Simon Lake, it is true, worked out a method by which a submarine could move over the floor of a channel; and we note that the inventor has lately claimed that this device, as perfected in later submarines, will make it possible to move on the bottom, cut loose the mines, and so get into a harbor. That this has been worked out to a practical conclusion, however, we very much doubt. Should a submarine manage to get through the mine-field, however, it might find itself opposed by entanglements consisting of heavy steel netting, or of interlaced cables hung in the manner shown in our illustrations of an actual device of this kind, as installed in one of the British harbors.



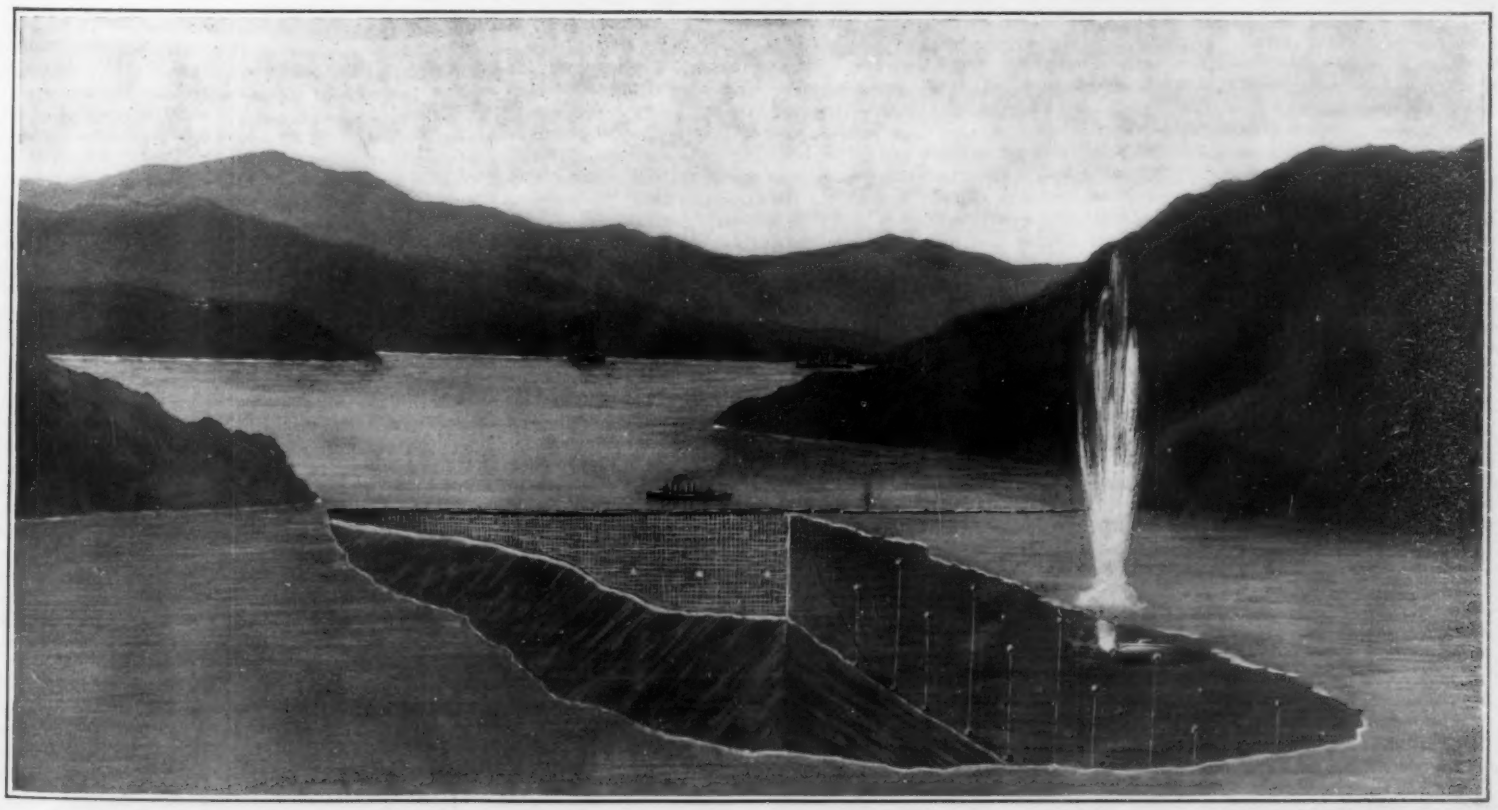
Torpedo net suspended by booms and wire cables from the side of a battleship.

War and Tuberculosis.—It is a well known fact that in every war the ravages of disease are far deadlier than those of rifles and machine guns. Typhus and typhoid, dysentery, diarrhœa, and cholera are among the most faithful followers and fatal foes of an army. But the danger of a great increase of tuberculosis in wartime has been hitherto overlooked. Dr. J. Kollarits, writing in the *Vienna Clinical Weekly*, calls attention to this with grave words of warning. In many individuals, he maintains, there are latent germs of the great white plague which the organism is strong enough to resist in the ordinary conditions of life, but which will speedily develop under the hardships, exertions, excitement, anxiety, and exposure of warfare.

"These men will soon become ill, retire from the fighting line with 'catarrh of the lungs,' and frequently there will be a failure to comprehend what is at the basis of the apparently harmless symptoms. The poorest, who need fresh air as much as daily bread, will lie ill at home, in the dust of villages or behind the closed windows of hospitals in big cities, where their condition will naturally not improve. It would be more effective treatment to place our sick heroes amid green woods or on sunny mountains, and I believe this would not be so difficult of accomplishment as at first thought it may seem.

"By the beginning of September most of the summer resorts in the mountains are closed and remain empty until the next summer. It would be a remarkably patriotic deed if the directors of these enterprises would turn their empty buildings over to the Military Bureau of Sanitation for this purpose. Thorough disinfection later would leave the next summer's guests nothing to fear. Specially desirable would be those places where one large hotel remains open, with many smaller ones closed."

A Trade-mark Decision.—Mr. Commissioner Moore in *ex parte* The Gamewell Fire Alarm Telegraph Company has held that it is essential to registration of a trade-mark even under the ten-year clause that the mark shall have been used as a trade-mark. In the same case he held that the mere size of the mark does not make it non-registrable; nor does the fact that it is applied to the goods by being made integral therewith in the process of manufacture. Further in the same case he held that a trade-mark described as a figure consisting of straight sides and curved top and bottom formed of two parallel lines was not registrable on the ground that it was merely an ornamental feature on the door of a police-telegraph box, and that the record does not show that it ever was used as a trade-mark or was so regarded by the officers of the applicant company.



Harbor defense, consisting of a mine field supplemented by a heavy steel net hung from solid log booms—an excellent defense against submarines, one of which is shown in contact with a mine.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, October 31st, 1914

The Campaign in France.

THE Germans are still forcing the fighting in France, as is natural since any delay in the decision is to the advantages of the Allies. The total population of the two Germanic empires in Europe is about 116,500,000, while the European population of the five allied nations is 232,000,000, almost twice as great. But in this war every nation is calling on its colonies and on the resources of all the world. A truer comparison of the resources of the combatants is obtained by comparing their total population. On this basis, the 132,000,000 Germans are contending against 722,000,000 Allies.

Germany especially has gained the advantage in the first three months of war, due to her efficient military system of the last thirty years. Her annual expenditures for her army have been less than those of France and only about two thirds those of Russia; yet she was able to develop a strength that made it possible for her to force the fighting into hostile territory both in France and in Russia. Of all of the nations now engaged in the great war, Germany seems to be the only one that was fully prepared when the trouble came.

After the failure of the great raid to crush the French in August, the Germans apparently intended to turn their forces against Russia in an effort to strike a blow there that would break up the Russian plans. The unexpected development of force by the Allies on their northern flank in France and the active raids of the Belgian garrison of Antwerp so endangered the German right flank that the Russian invasion had to be postponed until the line in France could be sufficiently strengthened to hold safely. This resulted in the campaign for the capture of Antwerp and in the advance of the German line to the coast and to the Franco-Belgian border.

The German operations in France during the last week might well be described as vigorous defensive tactics. They wished to deliver a telling blow in Russia, but at the same time it was necessary to keep the French and British busy in the west. The Germans again used their tactics of concealing the weakening of their line by using the remaining troops to make assaults. At all points of the line they have been making demonstrations of reconnaissances in force. At most points these attacks were repulsed; at others the opponents were driven back a few miles. At some the counter-attacks drove the Germans back an equal amount. At most points the net result of the operations has been practically no change in relative strength of the positions occupied. The Germans seem, however, to have achieved their object of holding the Allies while delivering their blow in Poland.

The proximity to England and the presence of British troops causes us to get most news from the Belgian theater of operations. This, too, has been the scene of the turning effort by the Allies and of the German counter-move against Dunkirk. While the contest seems to be settling down to a drawn battle on this flank, as in the center, there is still a chance for one side or the other to break through.

The advance to the Belgian coast and the occupation of Ostend gave the Germans a harbor of refuge for their submarines, two hundred and fifty miles nearer the Strait of Dover than their home port at Emden. They promptly took advantage of this and their submarines have already appeared in the fighting on the Belgian coast.

The advantage to the Germans of the capture of Dunkirk will be similar. It will give them a much better harbor and will bring their submarine base still closer to the British transport service in the English Channel. There is little probability of any aerial or naval raid against England from the channel ports if they should be captured, but in the contemplation of this imaginative use their value to the Germans has been overlooked. The great British base of operations on the Continent is at Le Havre. For the supply and reinforcement of her troops near the coast, though, she uses the shorter line through Dunkirk, Calais, and Boulogne. A further German advance would interrupt this last service and would handicap the British forces to some extent. Still more important, it would give the Germans a harbor of refuge close to the lines of mines by which the British have attempted to close the strait. By carefully working their way through the mine-field, the German submarines could reach the English Channel and could attack the British transports. The sinking of a number of ships loaded with troops might force Great Britain to abandon the shipment of troops and supplies to France until the danger could be removed. So great is the expenditure of life as well as of ammunition, in fighting on the scale of that in France, that any interruption in the forwarding service would soon cripple the operations at the front.

The first German attempt was made by rushing troops northwest from Lille toward Calais in an effort to cut in behind the forces of the Allies on their extreme northern flank. The rebound of this move carried the Germans back and resulted in a ten-mile advance by the Allies to Roulers, east of Ypres.

The German efforts are now being directed along a different line. By driving against the Belgians close to the coast they hope to break through to a position where they can threaten the rear of the opposing troops farther south.

The crossing of the Yser is the first step in this move. Much hard fighting will be necessary, however, before the attack can be carried further. The attacks at La Bassée, Lens, and Arras are parts of the same campaign, being, apparently, demonstrations to divert attention from the region selected for the main blow.

In the rest of the battle-line, from Arras to Verdun, the attacks and counter-attacks have nowhere changed the positions as much as five miles. The advantage in the small modifications of positions seems to lie slightly with the French.

There has been some very stubborn fighting, however, east of St. Mihiel, which is on the Meuse River half way between Verdun and Toul. Here the Germans have maintained their salient position under conditions that would ordinarily dictate a retreat. The presence of the heavy siege guns close to their front have prevented successful frontal attacks by the French, who have, accordingly, attempted to force the German retirement by pushing forward a strong army to threaten their rear. This French army advanced from Toul and Nancy and has now reached a position running eastward from the outskirts of St. Mihiel, through Apremont and Thiaucourt to Pagny, on the Moselle, twelve miles south of Metz. At the same time the French have pushed forward to the north of St. Mihiel until they have cut down to seven miles the strip by which the advanced German forces maintain connections with their main body. The position at St. Mihiel is apparently being held at great cost on account of its importance for some future move of the Germans. The latter are making desperate efforts to hold on, while the French are equally determined to make them loosen their grip on the Meuse fortifications.

The Russian Campaign.

In this campaign the fighting is as yet more open than that in France. The moves cover more ground and the advantages are correspondingly more obvious. The maneuvering of the troops has greater influence on the outcome than in the hammering process in the west, and the increased action adds to the interest.

The meagerness of the news is all the more to be regretted. The definite moves of the troops have to be gleaned from conflicting statements or determined from the necessary consequences of the announced movements.

The general campaign in this field also has, until the last few days, been one of aggressive action by the Germans. This has carried the fighting half way across Poland and has visited upon the hostile territory the ravages and the hardships of war.

The strategic dash from Silesia to the Vistula brought immediate results in the rapid retreat of the Russians from Tarnow and from Hungary, and in the weakening of their attacks in the north on Lyck, in East Prussia. The German force that made this advance in Poland was estimated at 800,000 men, yet they upset the plans of all of the Russian forces from East Prussia to Hungary, a total of over 2,600,000 men.

In the rapid march to the Vistula River, the German armies seem to have overstrained their supply service, particularly so on account of the unexpected rainy weather that made most of the roads impassable for automobile trucks. At the same time the Russians fell back steadily and drew in their forces from every direction. When the Germans and Austrians were fully engaged along the Vistula and the San rivers, from Warsaw to Stryi in Galicia, the Russians started south on October 13th with an army of cavalry and artillery that they had assembled under the protection of the fortress of Novo-Georgievsk.

The German left flank fell back to the line through Blonie and Plasezno, where they attempted, on October 17th and 18th, to stop the Russian turning movement. The threatening advance against their rear of Cossack divisions from Sochaczev, forty miles due west of Warsaw, soon forced the Germans to beat a hasty retreat. This left their northern flank unguarded, and on October 20th forced them to abandon their entrenched position along the Vistula between Warsaw and the Pilica River.

The further pressing of the Russian turning move forced the Germans back to Skierniewice, forty-one miles southwest of Warsaw, and forced them to call up troops from the south to help hold their flank. This gave the Russians their chance and, advancing from Ivangorod, they drove back the southern portion of the line of their opponents.

On October 23rd and 24th the German left flank made a stand at Lowicz and Rawa, but were forced back toward Tomaszow by the Russian attacks. At the same time the line opposite Ivangorod has withdrawn toward Radom.

The German plan of operations for the great battle included attacks all along the front while the Austrian army from Hungary turned the Russian flank on the south. This army performed its function in a close pursuit of the Russian columns and gained minor successes in rear-guard actions. When the Russians had drawn in their forces to Sambor and Stryi, they felt strong enough to make a stand. On this line and along the San River both the Austrians and the Russians claim successes, but no great change in relative positions seems to have occurred.

The advantage in the present fighting lies with the Russians, due partly to their strategic move against the German flank, and partly to the action of the elements in tying up the German transport service. The whole campaign is by no means decided yet, and the Germans and Austrians still retain the greater part of the advantages gained by them during the early part of October. The Germans still hold nearly half of Poland, while the Russians can claim a gain, in that they have checked one stage of the German plan of using their central position to deliver powerful blows in turn to the east and to the west.

The International Red Cross

IT is a singular coincidence that the eve of one of the greatest battles of modern times was also the fiftieth anniversary of the signing of the Geneva Convention which inaugurated the International Red Cross movement. For it was on August 22nd, 1864, that there was terminated the conference whose object was "the relief of the wounded of the armies in the field." It was Henry Durant in his "Souvenir de Solferino" who first suggested the idea of creating in times of war auxiliary societies for the relief of the wounded. At the call of the Society of Public Utility of Geneva an international conference met in that city in October, 1863, and formulated a set of resolutions which established that wonderful humanitarian movement which forms the bright background in the dark picture of modern warfare. In order that these resolutions might have the force of a treaty a diplomatic conference met in Geneva at the request of the Swiss National Council under the patronage of Napoleon III. The representatives of twelve nations signed the famous pact which has since been known as the Geneva Convention. Too well known to need repetition is the story of the remarkable growth of the Red Cross movement which received its official impetus on that day—the movement which has enlisted the co-operation of every nation of the globe, and which has extended its sphere of usefulness beyond the battlefields of war to scenes of famine, of pestilence, and of industrial disaster. It may be of interest to Americans to know that the Geneva Convention was signed in the hall which was later named the "Hall of the Alabama" after the court of arbitration which met to settle the *Alabama* claims which had been a bone of contention between Great Britain and the United States. France was the first nation to become a signatory to the Geneva Convention, and although the United States had taken part in the original conference, it did not ratify the action of its representatives until 1882. The last nation to fall in line was Ecuador in 1907. In the meantime the articles of the Convention of 1864 were superseded by those of the Convention of 1906, of which the United States had the honor of being the first signatory. Apart from participation in the International Red Cross, the different nations have established their own National Red Cross organizations, the first of which was founded in Würtemberg in 1863. The American organization was born in 1866. The world-wide efficiency of the latter needs little comment. Of the contributions made to the Red Cross funds for the relief of the wounded of the five nations that took part in the Balkan Wars of 1912, the largest sum of money came from the United States.—*Medical Record.*

A Hot Wave in Egypt

A PERIOD of remarkable heat occurred in Egypt May 29th-June 2nd, 1914. At Helwan there was a maximum temperature of 113 deg. Fahr. on the 1st, the highest recorded at that place since the beginning of observations in 1904. While this was the maximum for Egypt proper, higher readings were recorded at Nubian stations, the maximum being 118.4 at Merowe, June 2nd.

The Austrian 12-inch Howitzer

Heavy Siege Pieces Which Were Used at Namur, Maubeuge, and Antwerp

IN these days of strict military censorship and inventive and not over-scrupulous war correspondents, it is difficult to select out the true from the false, and so piece together the all-too-scanty fragments of reliable evidence as to get at the truth.

Photographs do not lie, and by the aid of these and the official dispatches, it begins to be clear what kind of heavy ordnance it is that the armies of the Dual Alliance have been using with such deadly effect.

Apparently there are three types: an 11-inch German howitzer; a 12-inch Austrian howitzer; and a German 16-inch siege gun. The first two pieces have been freely photographed—the huge 16-inch piece has, apparently, so far escaped the camera.

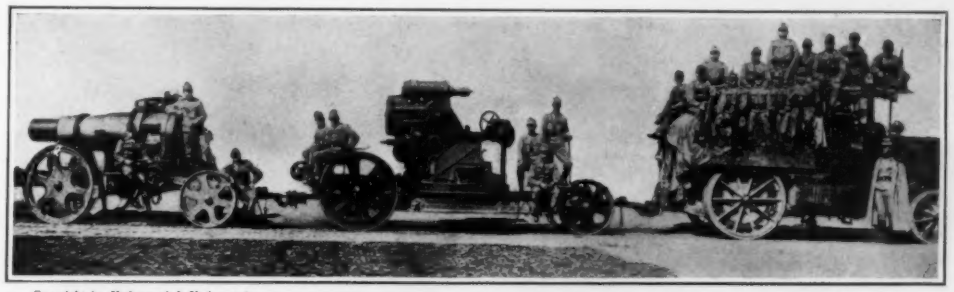
We present some very interesting photographs of the Austrian 12-inch howitzer, which is reputed to have been built in considerable numbers at the Skoda works.

Report has it that Austria sent several of these pieces to Belgium and France for use in the German attack, and that they were manned by Austrian artillerymen. That this was so would seem to be proved by our photographs of this gun, in which the artillerymen are Austrians and the country has the characteristic appearance of Flanders.

The outfit of one gun consists of the motor car carrying the gun detachment, a car carrying the foundation bed, the turntable and mounting, including the sleeve and recoil gear, and a car for the gun.

We doubt if this powerful piece is fired from its car. A study of the photographs indicates that the base of the turntable platform is flat and reinforced by heavy angles. If so, the mounting could readily be transferred to a prepared concrete base and bolted in place. Some of these guns were emplaced in front of the English troops near Soissons, where frequent mention was made of the concrete emplacements.

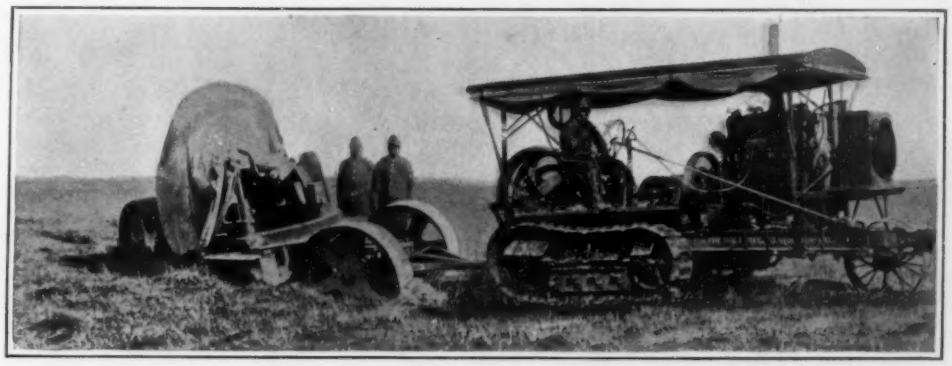
That these heavy pieces lose their mobility and are liable to capture if they leave the macadam roads is shown by our photograph of one section (the mounting) sunk to the hubs in a wheat field.



Copyright by Underwood & Underwood.

An Austrian 12-inch howitzer in transit.

Official dispatches have stated that Austria has sent several of her 12-inch siege howitzers to Belgium and France. Here we see the tractor with the gun detachment, the turntable and sleeve and recoil cylinders, and the gun barrel, each separately mounted for transit.



Mired to the axles in a wheatfield.

German and Austrian heavy siege artillery gets into difficulties when it leaves the macadam highway for plowed fields.

A Giant Rubber Tree

THE *Bulletin* of the Belgian Society for Colonial Research announces the discovery of an immense rubber tree in the borderland of Bolivia. It measures 8.25 meters in circumference at the base (about 27 feet) and the daily yield of caoutchouc for 120 days in the year is 10 kilogrammes. It belongs to a family of seven persons, and constitutes their entire support, which ought to be a very comfortable one, since *La Revue* (Paris) estimates from this yield that at the present value of rubber the tree represents a capital in round numbers of 300,000 francs ($60,000).

Bonding Asphalt to Concrete

THE necessity frequently arises in engineering works for joining concrete work with asphalt, especially in reservoir construction, but in this considerable difficulty has been experienced. Recently a new method has been tried in San Francisco, where the concrete surface was first painted with coal tar, and it was found that when applied in this way under right conditions the asphalt would adhere so firmly that after it had cooled it could not be broken away without bringing pieces of concrete with it. In order to secure this result the concrete surface was first scrubbed clean with a bristle brush, and over this a thin coating of hot coal tar was "painted." The coal tar should be heated in small quantities, brought just to the boiling point, and then applied immediately. Heating the coal tar in large quantities, which necessitated some delay before it could all be used, did not give such good results, and the men were therefore not allowed to heat more at a time than they could apply quickly as soon as it began to boil. The asphalt was spread over the tarred surface in the usual manner.

The Naval Losses of the War

Analysis of the Methods of Attack of the Opposing Fleets and Their Results

A STUDY of the accompanying tables, showing lists of the ships which have been lost by the contending navies of Great Britain and Germany, proves how accurate was the forecast of naval experts as to the nature of the strategy and tactics of the opposing powers in the event of a great naval war between England and Germany.

Look at the column in these tables which is headed "How Lost"; and it will be seen at once that the damage inflicted by the Germans has been wrought almost entirely under the surface of the sea, whereas the losses inflicted by the British have been achieved almost entirely above water—in other words, the Germans have achieved their successes with the mine and the torpedo and the British with the gun.

It has always been contended that the submarine, and to a less degree the mine, was the weapon of the weaker power, and therefore presumably of the defense. The events of the present naval campaign have proved the truth of this supposition to an absolute demonstration.

That the Germans have accomplished so much with the mine and the submarine does not mean that the British are not experts with these weapons. Germany, being on the defensive, with her ships closely blockaded in her own ports and waters and protected by mine fields, booms, cables, and netting, it follows that her ships, except for the few which occasionally venture out for a reconnaissance, are inaccessible to the submarines and the floating mine. British submarines which have ventured into the mouths of the Elbe, the Weser and the Ems, have found the capital ships of the Germans absolutely protected against submarine attack—and this is as it should be. Germany is holding her ships of the line for that future day (which she hopes may come) when the depredations of her submarines and the accidents of the sea shall have so far worn down the numerical superiority of the British fighting line, that she may venture out for a battleship engagement with at least a fighting chance of success.

In looking at the list of British successes, it will be noted that they have been won almost entirely by the "man behind the gun." It has been believed by our naval officers that when they were put to the test of war, both the guns and the gunners of the British navy would prove to be first-class in quality; and certainly a study of the list of German losses would indicate that this confidence was well placed.

Whether the inability of the German gunners to hold their own against the British has been due to the lighter weight of their batteries, or to lack of skill in gunnery, or to both, can only be definitely known after the war, when its results come to be critically analyzed by the naval expert. For many years the SCIENTIFIC AMERICAN has drawn attention to the fact that the Germans were possibly making a mistake in arming their ships, big and little, with guns of lighter caliber than those of their possible opponents. The 4-inch guns of the "Mainz" were no match for the 6-inch and 4-inch guns of the "Arethusa"; and this raises the question whether the 11-inch guns which form the principal armament of the battleship fleet of Germany will not be similarly overwhelmed on the day of battle by the 12-inch, 13.5-inch and 15-inch guns against which they will be opposed, should a great fleet action ever take place in the North Sea.

NAVAL VESSELS LOST BY THE BRITISH AND JAPANESE NAVIES.

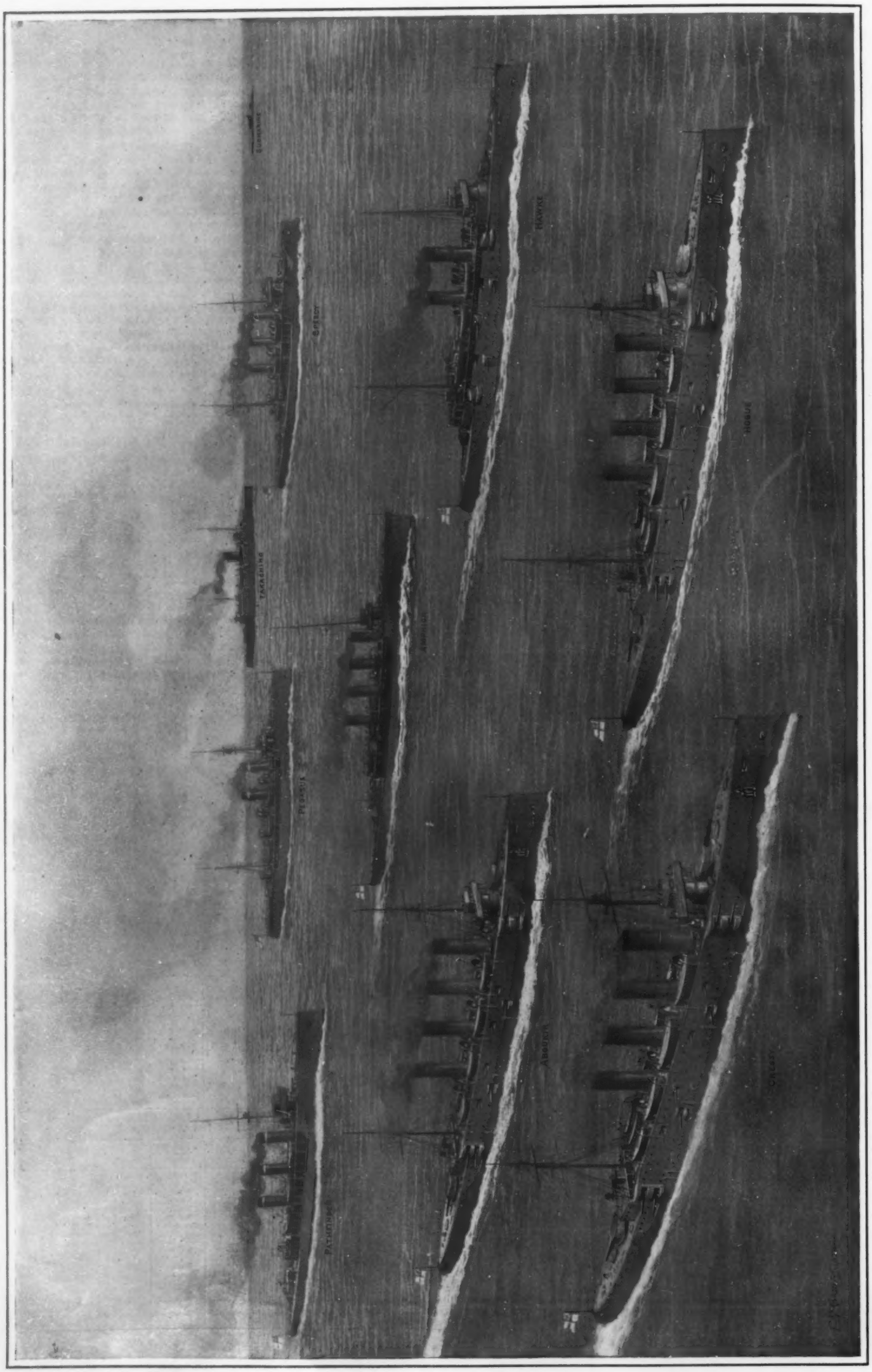
NAME OF SHIP	TYPE	Date	Displacement	Speed Knots	Main Battery	HOW LOST
Cressy	Armoured Cruiser	1901	12,000	19.5	2–9.2-in. 12–6-in.	Submarine.
Aboukir	Armoured Cruiser	1902	12,000	18.5	do	Submarine.
Hogue	Armoured Cruiser	1902	12,000	18.0	do	Submarine.
Hawke	Protected Cruiser	1891	7,350	19.5	2–9.2-in. 10–6-in.	Submarine.
Amphion	Scout Cruiser	1912	3,440	27	10–4-in.	Mine.
Pathfinder	Protected Cruiser	1904	2,940	25¼	9–4-in.	Mine or Submarine.
Speedy	Gunboat	1893	810	18	2–4.7-in.	Mine.
Takachiho	Protected Cruiser	1885	3,700	18.5	8–6-in.	Torpedo.
Not known	Submarine	.....	.....	.....	.....	.....
Pegasus	Protected Cruiser	1897	2,140	21.0	8–4-in.	Disabled by gun-fire.

NAVAL VESSELS LOST BY THE GERMAN NAVY.

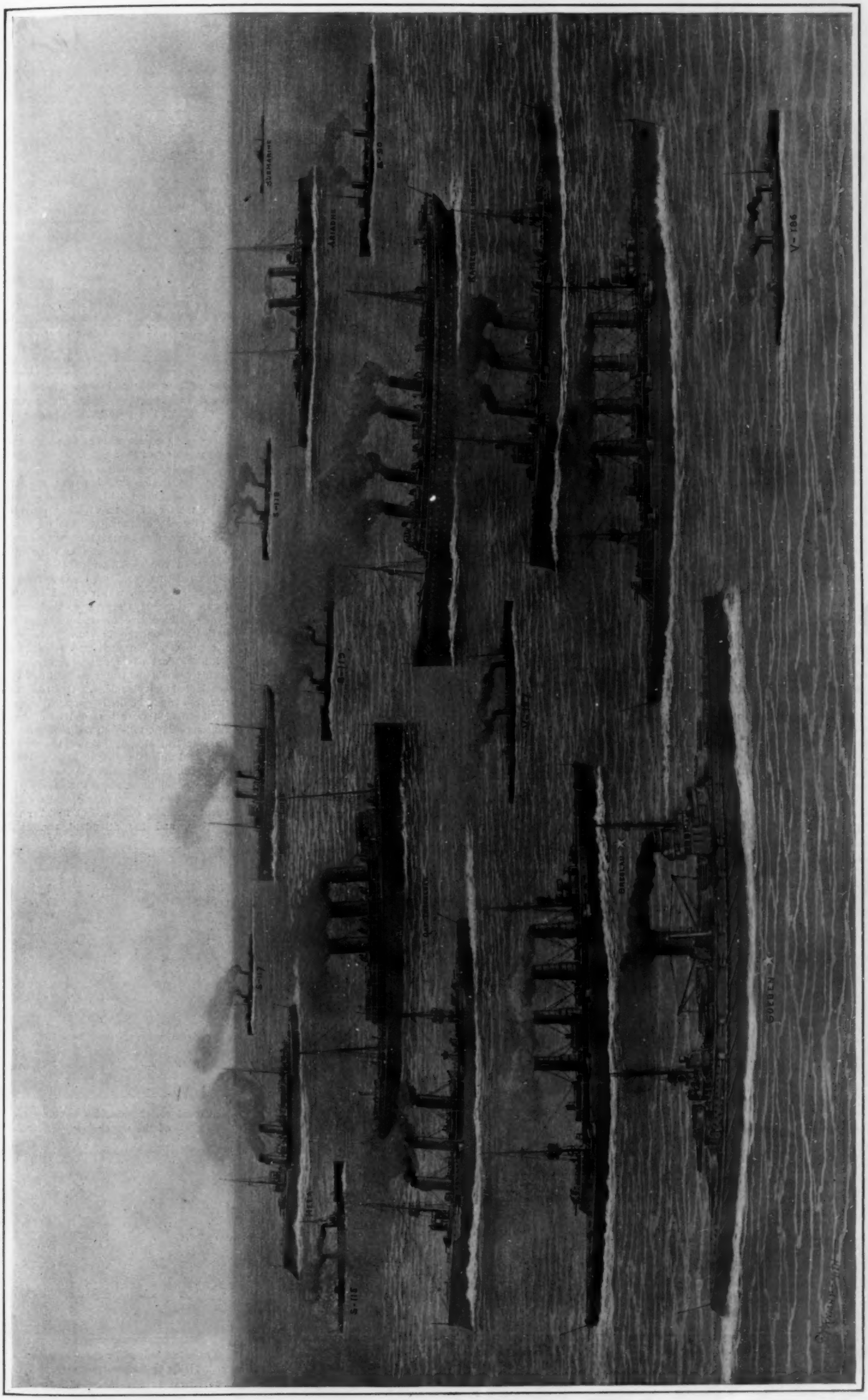
NAME OF SHIP	TYPE	Date	Displacement	Speed Knots	Main Battery	HOW LOST
Goeben	Battle-Cruiser	1912	23,000	28	10–11-in.	Fled to Turkey.
Breslau	Scout Cruiser	1912	4,550	28	12–4-in.	Fled to Turkey.
Magdeburg	Scout Cruiser	1912	4,550	28	12–4-in.	Aground: blown up.
Mainz	Scout Cruiser	1909	4,350	27¼	12–4-in.	Sunk by gun-fire.
Köln	Scout Cruiser	1910	4,350	26¾	12–4-in.	Sunk by gun-fire.
Ariadne	Protected Cruiser	1901	2,660	21¼	10–4-in.	Sunk by gun-fire.
Hela	Protected Cruiser	1895	2,040	18	4-3.4-in.	Sunk by submarine.
Kœnigen Luise	Mine-layer	1913	1,800	20	.....	Sunk by gun-fire.
S–115	Destroyer	1902	420	28	3-18" tubes	Sunk by gun-fire.
S–117	Destroyer	do	do	do	do	do
S–118	Destroyer	do	do	do	do	do
S–119	Destroyer	do	do	do	do	do
V–186	Destroyer	1911	650	32.5	do	do
V–187	Destroyer	do	do	do	do	do
S–90	Destroyer	1900	400	26½	do	Sunk by submarine.
Not known	Submarine	.....	.....	.....	.....	Rammed by destroyer.
K. W. der Grosse	Auxiliary Cruiser	1900	21,000	23	10–4-in.	Sunk by gun-fire.
Cap Trafalgar	Auxiliary Cruiser	1913	26,000	18	8–4-in.	do

Women Explorers in Siberia

AN interesting expedition is being sent out by the universities of Oxford and Moscow under the leadership of Miss M. A. Czaplicka, who holds a traveling scholarship of Somerville College, Oxford, to study the tribes of the Yenesei region, in northern Siberia. The rest of the party are: H. A. Hull of the University of Pennsylvania, in charge of physical anthropological work; Miss Haviland, zoologist and ornithologist; and Miss Curtis, photographer. The expedition will spend a year in investigating the Tungus and Ostiaks, concerning whose customs and religious beliefs several points still remain unsettled.



NAVAL SHIPS, OF AN AGGREGATE DISPLACEMENT OF 54,240 TONS, THAT HAVE BEEN LOST TO THE BRITISH AND JAPANESE NAVIES IN THE PRESENT WAR



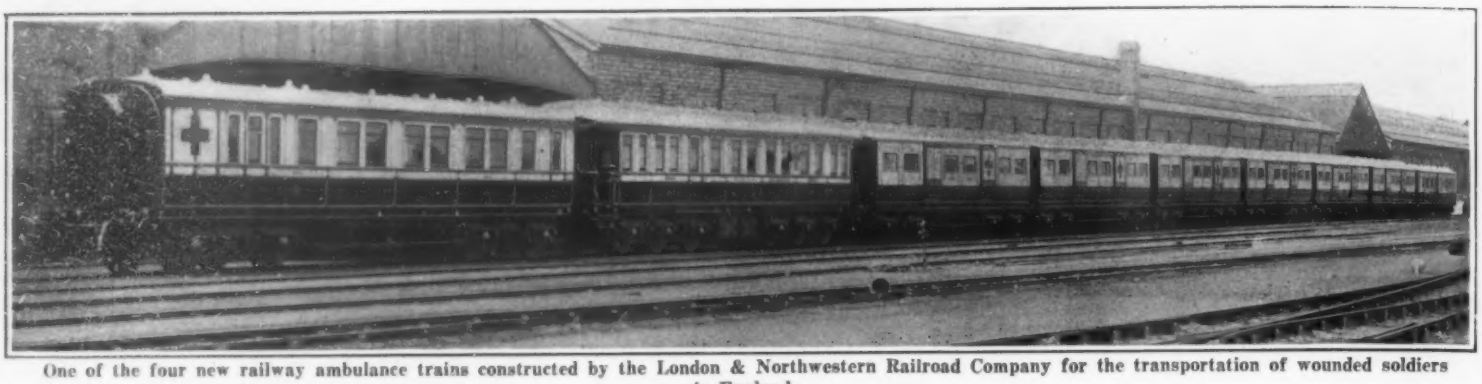
NOTE.—The "Goeben" and "Breslau" fled to the Dardanelles and have been sold to Turkey.

NAVAL SHIPS, OF AN AGGREGATE DISPLACEMENT OF 97,680 TONS, THAT HAVE BEEN LOST TO THE GERMAN NAVY IN THE WORLD WAR

Medical Science in the Service of War

Wonderful Improvements in Methods of Saving Life

By Charles Bolduan, M.D.



One of the four new railway ambulance trains constructed by the London & Northwestern Railroad Company for the transportation of wounded soldiers in England.

The vehicles were taken from mainline traffic and altered for hospital use in thirty hours.

IN all the pages of war news with which the daily press is flooded, perhaps no greater tribute could be found to modern medical science than the following dispatch:

"A correspondent in Ostend says that among the French wounded in recent fighting was a dragoon with six bullet and three bayonet wounds in the upper part of his body. He was expected to recover."

In the Franco-Prussian war a man similarly wounded would not have had a chance for recovery, that is, not if he had been taken to a military hospital.

When men are called to war, a great deal is said about the glory of fighting for the country and dying on the field of battle. Very little mention is made of the illnesses which befall the soldier who goes through the battles unscathed or his comrade who is wounded on the field. According to a statement made by a member of the Health Department of the French Ministry of War, "of every hundred men placed *hors de combat*, only two are killed." The problem of caring for the sick and wounded is therefore of the utmost gravity. But right here the inconsistencies of war are obvious. Each country maintains Red Cross workers whose duty it is to care for the wounded of the enemy as well as for the men who come by their wounds in the defense of their flag. These men and women, while engaged in aiding the victims of warfare, are still in the position of praying for victory for their army. And victory for their army means what? The slaughter and maiming of the enemy.

Photo by International News Service.

Major Richardson of the British army and two of the famous hounds that he has trained for Red Cross work on the battlefield. Major Richardson is well known for having introduced the dog into the police service.

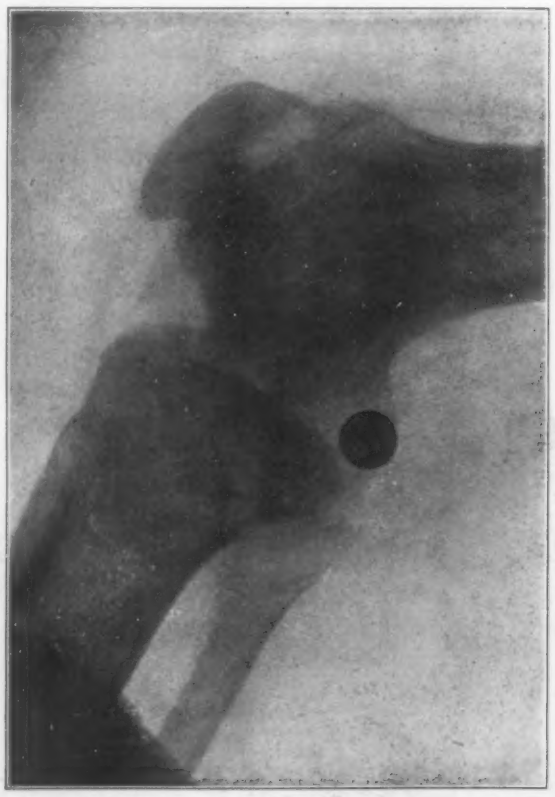
Infection a Matter of Course.

In the Franco-Prussian war the surgeons looked upon the infection of wounds as a matter of course. They regarded the presence of the attendant pus as a necessity, and as long as the pus was what was known as "laudable" they were satisfied with the condition of the patient. Other patients developed another form of pus, streptococcal, which caused the doctors of those days gravely to shake their heads and prepare for the death of the patient. Even the best hospitals were not properly ventilated and were filled with the foul odors emanating from infected wounds and gangrene. All this was considered unavoidable. At that time suppuration and kindred complications in wounded men were regarded as of spontaneous origin, although the researches of Pasteur had already pointed the way to a general understanding of germs. When, at length, purulent infection was found to be the result of germs, disinfectants were brought into use. Carbolic acid was the agent generally employed at first for that purpose, and the attendant success in

Effect of shot through second and third fingers.

Bullet lodged in left hand.

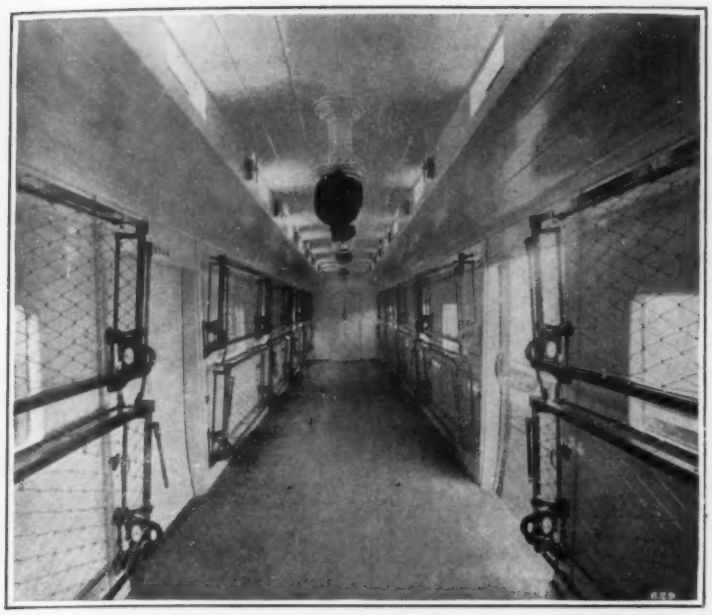
Fragmented rifle bullet in muscles of the neck. Only danger of infection.



Shrapnel bullet behind the knee joint. Evidences of festering of the joint itself are apparent.

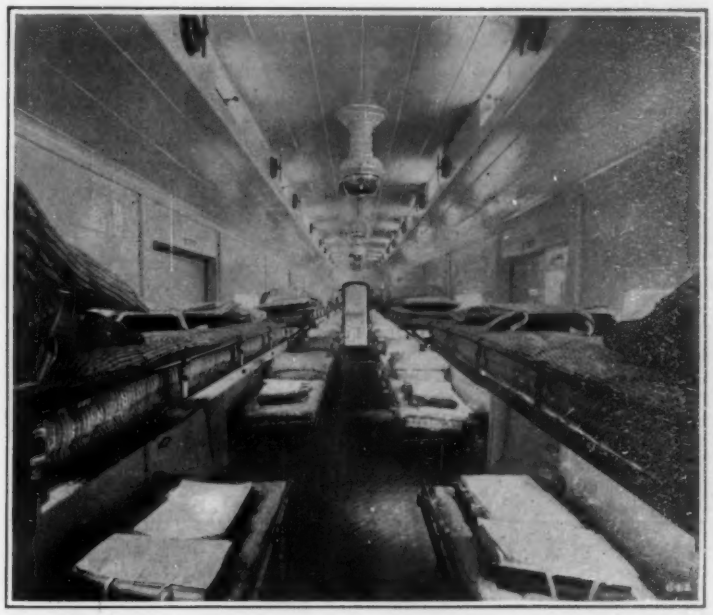
Shrapnel bullet embedded in the bone of the upper jaw.

Projectile lodged in chest muscles. Yields to simple treatment.



The ward cars of the British ambulance trains were converted from open freight cars.

They were refloored, and hooks were fixed in the ceilings for suspending folding cots in two tiers on both sides.



View down the center of ward car of a military ambulance train showing fixed berths and cots.

In the center of each train is a pharmacy car with treatment room, office, and all necessary supplies.

treating surgical injuries and in performing operations where carbolized dressings were used and the air was subjected to a carbolic acid spray, caused the most profound amazement.

During the Franco-Prussian war 138,871 wounded died in the hospitals, while uninjured sick dying in the hospitals numbered 328,000. Many of these soldiers, if they recovered sufficiently to leave the hospital, were wrecks for the remainder of their lives. In contrast to the hospital treatment in the Franco-Prussian war let us glance at the Russian-Japanese war. In the great military hospital of the Japanese at Hiroshima there occurred but thirty-four deaths among 9,862 wounded. At first glance this low mortality might be attributed to the fact that the Japanese soldiers as a whole maintained such a high physical standard. But when the fact is considered that this hospital also cared for large numbers of Russian patients, and the death rate among them was approximately as low as it was among the Japanese, the credit must be given to advanced medical science.

A Lesson in Personal Hygiene.

The Russian-Japanese war taught a valuable lesson in personal hygiene. The habit of extreme personal cleanliness among the Japanese was an important factor in maintaining the health and resistance of Japan's troops. The Japanese troops kept their bodies clean by frequent bathing, and their rule of never going into battle without putting on clean underwear greatly reduced the danger of infection from wounds. The Japanese rations also had much to do with keeping the men in good condition. These generally consisted of some rice, compressed fish, army biscuit, salted plums, and a juicy pickle all neatly packed in a small tin box and wrapped in a towel. The Russian was fed on soup frequently made from questionable meat, and this has been held responsible for the large proportion of intestinal disorders on the Russian side.

While to-day the war machinery is more deadly, the number of killed and wounded in percentages remains about the same. The small steel-jacketed bullet used in rifle fire makes a clean wound, which rarely becomes infected unless a piece of cloth is carried into the wound with it. In the British army it has been found that bullets will pass through khaki linen, making a clean slit, and will not carry any particles of cloth into the wound. In the case of wool, such as Highland kilts or heavy flannel shirts, bits of wool are frequently introduced into the wound, and when this occurs, suppuration invariably follows.

First Aid Field Kits.

The use of the first aid field kit is of great importance. During the Boer war the British army carried field kits which contained a piece of gauze, a pad of flax charpie between layers of gauze, a gauze bandage four and a half yards long, a piece of mackintosh waterproof, and two safety pins, all of which was carefully packed in an air-tight cover. Another thing which the British found very desirable for field use was a paste for immediate antiseptic dressing on the field of battle. This paste was made up of mercury and zinc cyanide, tragacanth in powder, carbolic acid, and sterilized water. This paste was contained in a collapsible tube, and was particularly satisfactory in that form as it could be carried easily, and, when spread over a wound, would remain in place no matter what position the wounded man assumed. When the wounded arrived at the field hospital the surface surrounding the wound was cleansed with a solution of bichloride of mercury 1 in 1,000, or a two and a half per cent solution of carbolic acid. The wound itself was then cleansed and dressed with double cyanide of mercury and zinc which was covered with a pad of wool and a bandage.

To-day if a soldier is so wounded that an amputation is necessary he knows that he can usually undergo the operation with the chances in his favor. In the Franco-Prussian war, even with the aid of anæsthetics, only forty out of a hundred men who underwent amputations lived to tell the tale. The knowledge of aseptic surgery which army surgeons possess to-day permits of a patient coming through an amputation with a minimum amount of danger.

It is generally conceded that in the case of bullet wounds where the bullet is retained an operation should be avoided. Unless the bullet is directly under the skin or in such a position that the patient's life is in imminent danger, it is best to allow the bullet to remain. The modern rifle bullet is unlikely to cause infection, and frequently may be carried in the body without causing either danger or pain, while the results from an operation, performed in a field hospital, in more or less haste, may be questionable.

Disease More Dangerous Than Bullets.

The fire of the enemy is by no means the only risk to which the soldier is subjected. Where large bodies of men are gathered into small quarters there is always the danger of disease. Before anti-typhoid vaccination was introduced typhoid fever rivaled the enemy's fire in the terrible toll it took among soldiers. In the Franco-Prussian war in the year 1870 there were 73,000 cases of typhoid fever in the German army. Out of this number there were 7,000 deaths. In the Boer war the British army suffered from typhoid fever to the extent of 57,000 cases, of which 8,000 died. During the war with Spain the United States Army was ravaged with typhoid fever. In 1898 there were 20,738 cases and 1,580 deaths among 108,000 men. In other words, one man in every five contracted typhoid fever. Even among the troops which never left the United States, but remained in the various concentration camps at home, one man in every six came down with the disease. In 1898 nine tenths of the deaths which occurred among the troops in the United States were caused by typhoid fever.

Typhoid fever is a preventable disease, particularly in armies. There are two ways in which it may be

(Concluded on page 394.)

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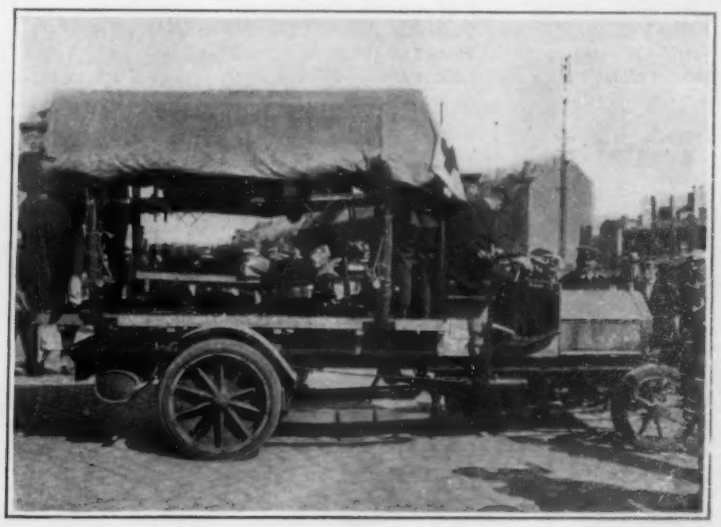
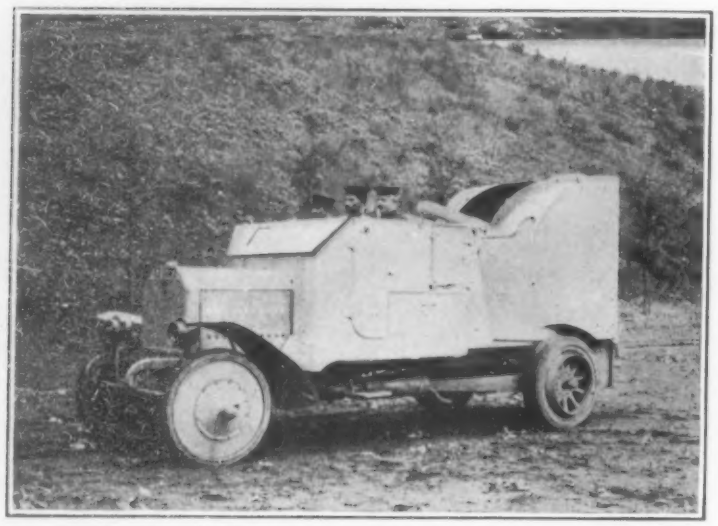
Belgian Red Cross nurses and ambulance men carrying a wounded Belgian bugler into the hospital at Willobroeck, near Malines.



A motor truck used by the Germans as an ambulance. The wounded lie in two tiers upon stretchers.



Mercedes armored car used by the German army.

Italian armored car of the Isotta Fraschini type.

Armored Automobiles in War

Construction of Modern Battle Cars

By John J. Ide

As was to be expected, reports from the various seats of war tell us of the widespread use of armored automobiles. Most of the nations involved have made exhaustive experiments to determine the most suitable of the types which range all the way from ordinary touring cars the sides of which are covered with steel plates, to huge moving forts. The most satisfactory cars have, naturally, proved to be those between the two extremes.

The service required dictates to a large extent the design of the car. In the early days of the war, the Germans made great use of standard N. A. G. and Opel touring cars, to the sides of which are fastened steel plates of 4 millimeters thickness. No guns are mounted on the cars, the occupants being armed simply with rifles. Owing to the comparatively slight increase in weight over ordinary touring trim, these cars possess mobility of a high order and are well suited for scouting. They generally carry on each side of the dash a vertical rod having a knife-edge in front. The object of this is to sever any wires which may be stretched across the road, generally at the height of the pilot's head.

Much heavier armored vehicles have also been made use of by the Germans. These are generally trucks on which are maintained 5- or 7-centimeter Krupp or Erhardt guns. The armor plating is very heavy, being about one half inch in thickness. The rear wheels have twin solid tires and the front disk wheels have single tires of the same type.

The Belgians possess few, if any, heavily armored automobiles. They pin their faith to lightly armored, highly mobile cars, which have proved highly successful. Their speed and ease of manipulation enable them to rush to the desired spot, make a sharp attack, and, if necessary, retire quickly.

The detail illustrations show an ordinary touring car fitted with armor plating and carrying a quick-firing gun. Except for the gun, it is almost a replica of the German machines of the corresponding type. The steel plates are fitted to the interior of the body panels and project about twenty inches above the sides. The steel windshield with a hole for the driver to see through will be noticed. An interesting point is the guard on the driver's right to protect him when manipulating the levers, which happen to be mounted outside the body, thus rendering impossible the same protection as elsewhere.

A number of well designed cars armed with quick-firers were recently turned out by the Minerva Works, unfortunately destroyed during the bombardment of Antwerp. The armor throughout is of 5 millimeters compressed steel. A few cars were tried with armor plating ½ inch thick, but they were found too heavy to give the same service as the more lightly armored chassis of similar power.

The radiator is protected by steel flaps which can be hooked in a semi-closed position, allowing sufficient cooling for ordinary purposes. Air circulation around the engine is assisted by an outlet on top of the hood. The twin tires on the rear wheels are a good feature quite apart from their great weight-carrying capacity, as they might enable the car to escape from a dangerous position in case a lucky rifle shot punctured one of them. The steel plate fixed behind the rear tires protects them to some extent. The efficient front wheel mudguards and position of the headlight will be observed. These cars are equipped with Knight engines of 26 and 28 horse-power.

The last word in Belgian armored car design is represented in the photograph of the S. A. V. A. The gun is mounted in a hemispherical revolving turret. These cupola-topped cars have two defects. One is, that there not being quite sufficient ventilation, the cupola gets filled almost to suffocation with gas; the other is that the ejected cartridge cases often strike against the back of the turret, ricochet back and hit the marksman in the head. Better protection to the occupants, however, helps to offset these drawbacks. The increased weight due to the roof certainly seems to demand greater tire support than is here provided. From the number of headlights fitted one would hazard a guess that the car was especially designed for night work.

So far, little has been heard of French armored cars in the war. It is known, however, that the authorities possess a number of "traveling forts" manufactured by Charron (formerly Charron, Giradot et Voigt), and Schneider of Le Creusot.

The Charron machine consists in principle of a closed car of armor plate provided with a machine gun mounted in a rotating turret. Running around the outside of the turret is a flange that rests upon the edge of the circular aperture in the roof. Referring to the sectional drawing, a rubber ring *A* is fitted under the flange to prevent movement of the turret during firing. The cupola is mounted on a central shaft supported from the frame of the car. The shaft is in two sections, the adjacent extremities of which are united by a nut provided with the hand wheel *B*. Rotation of the hand wheel causes the turret to rise and fall slightly. At its lowest point it is pressed down on the

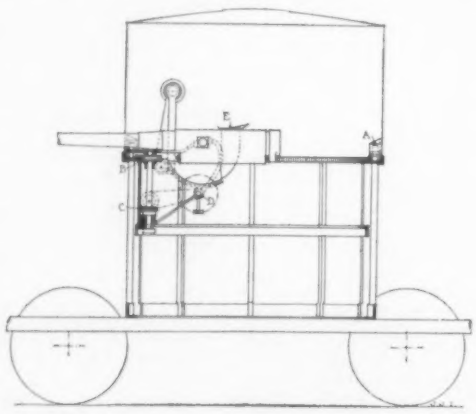
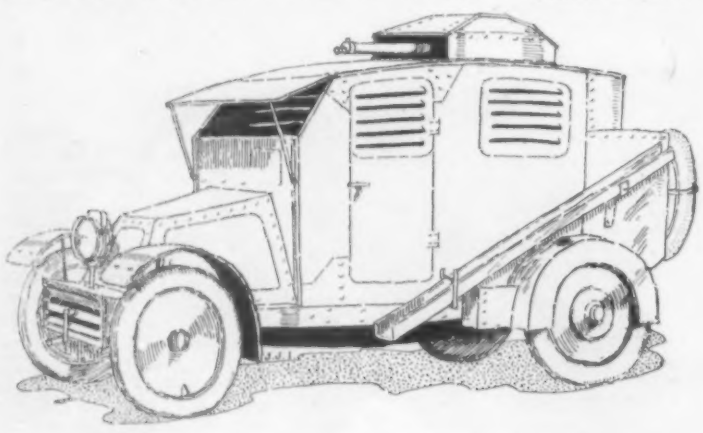
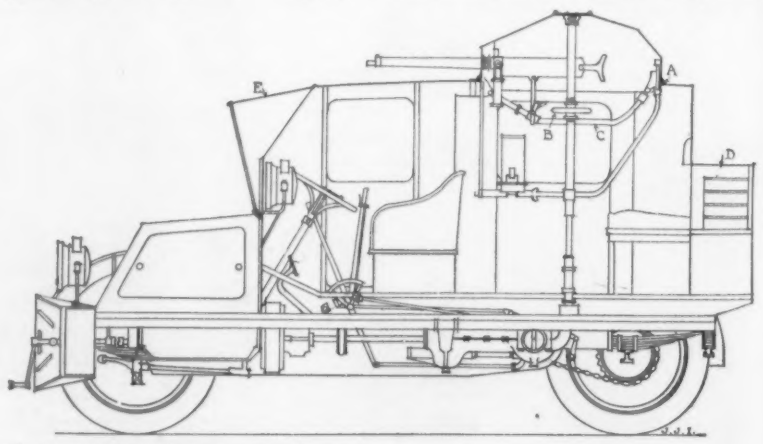


Fig. 1.—Sectional view of Schneider armored car.

A, rollers for revolving turret. *B*, gear wheel for actuating turret. *C*, bevel gearing through which pedal-driven spindle *D* is made to drive gears *B*. *E*, seat for gunner.





Figs. 2 and 3.—Exterior and sectional views of the Charron armored car.

A, rubber ring for clamping turret when firing. *B*, handwheel for elevating or depressing cupola. *C*, cross-bar on which gun is mounted. *D*, ammunition chamber. *E*, shield.

rubber ring and is absolutely immovable. When it is desired to train the gun afresh, the hand wheel is turned, thus raising the cupola slightly and allowing it to be rotated in the required direction. The machine gun, mounted upon the cross-bar *C*, is equipped with the usual elevating gear. The ammunition chamber *D* is at the extreme rear in a rather exposed position. Behind that again is fastened a spare tire, for, heavy as this machine is, the tires are pneumatic. In front of the driver is a hinged shield *E* which can be opened to any desired degree or completely closed, if desired.

The radiator, carried in a low position forward, is protected by steel plates with louvres arranged to admit a modicum of air. The machine is provided with two lamps, one mounted on the radiator, and another carried on a bracket behind the dashboard, in which is cut an aperture provided with a shutter, so that signaling can be indulged in. On each side of the vehicle just over the rear wheel is placed a girder, used to bridge over ditches, etc.

The Schneider armored car in general appearance is not dissimilar to the Charron. A special form of cupola is used, however, of which a sectional drawing is given. The turret is in two parts, a lower cylindrical portion of which is attached to the frame of the car and is a fixture, and a rotatable turret above, likewise cylindrical. The latter is provided with rollers *A* running upon an inwardly projecting ring on the fixed turret. On the inner side of the ring are teeth engaged by the gear wheel *B*.

A pair of brackets attached to the rotatable turret carry the gun. These brackets also support the shaft on which the gear wheel *B* is fixed. The gear wheel revolves through the agency of the bevel gearing at *C* and a chain connected to the spindle *D*.

A bicycle seat is placed on the gun and the spindle *D* carries cranks and pedals. Thus the gunner, seated on the saddle, is able, by pedaling, to rotate the turret and with it the gun, leaving both hands free for aiming and operating the weapon. The scheme is certainly ingenious, but seated as he is astride the gun, the marksman must feel the full effects of the recoil.

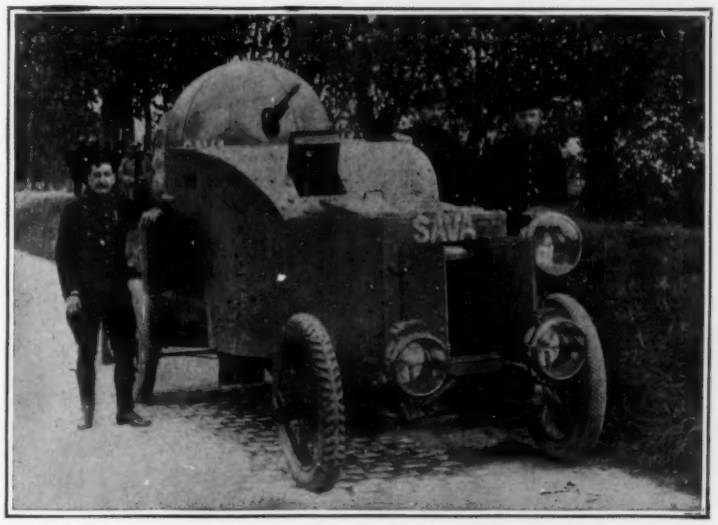
So far as known, the English armored automobiles are merely light Daimler trucks of the subsidized type. Several successful raids have been carried out by Commander Samson, who is a member of the Naval Flying Wing.

As Italy may yet be dragged into the conflict, the type of armored car on which she relies may be of interest. As seen from the accompanying photograph of an Isotta Fraschini, the type more nearly approaches a fort on wheels than any of the machines previously described. The lack of observation facilities at the sides is a point not above criticism. The rear wheels and under body are very well protected, as is the radiator.

An Italian artillery major de Sauteiron has produced an automobile battery consisting of four machine guns, two mounted on each side. The sides of the vehicle can be swung out to bring all the guns into line.

Strange as it may appear to Americans accustomed to self-starters on every form of automobile, not one car is, I believe, similarly equipped. Yet a moment's reflection will show the desirability, if not absolute necessity, of such a fitting. Several extremely narrow escapes have occurred already through one of the crew having to restart the motor when the car was under fire. It is to be hoped that all armored automobiles will, in future, possess engine starters.

Belgian touring car fitted with protective armor.



Type of car that has been used very effectively by the Belgian army.

Darwin's Theory No Longer Accepted

DARWIN'S theory of the origin of species has been generally accepted for many years, but since its enunciation the progress and discoveries of science have raised doubts as to its value. The necessity that every theory of evolution must be in accord with the more recently discovered facts of physics and of chemistry is emphasized by Prof. William Bateson, president of the British Association for the Advancement of Science, in his recent address at the meeting in Australia, in which he referred to the subject as follows:

I suppose that everyone is familiar in outline with the theory of the Origin of Species which Darwin promulgated. Through the last fifty years this theme of the natural selection of favored races has been developed and expounded in writings innumerable. Favored races certainly can replace others. The argument is sound, but we are doubtful of its value. For us that debate stands adjourned. We go to Darwin for his incomparable collection of facts. We would fain emulate his scholarship, his width and his power of exposition, but to us he speaks no more with philosophical authority. We read his scheme of evolution as we would those of Lucretius or of Lamarck, delighting in their simplicity and their courage. The practical and experimental study of variation and heredity has not merely opened a new field; it has given a new point of view and new standards of criticism. Naturalists may still be found expounding theological systems which would have delighted Dr. Pangloss himself, but at the present time few are misled. The student of genetics knows that the time for the development of theory is not yet. He would rather stick to the seedpan and the incubator.

In face of what we know of the distribution of variability in nature the scope claimed for natural selection in determining the fixity of species must be greatly reduced. The doctrine of the survival of the fittest is undeniable so long as it is applied to the organism as a whole, but to attempt by this principle to find value in all definiteness of parts and functions, and in the name of science to see fitness everywhere is mere eighteenth century optimism. Yet it was in application to the parts, to the details of specific difference, to the spots on the peacock's tail, to the coloring of an orchid flower, and hosts of such examples, that the potency of natural selection was urged with the strongest emphasis. Shorn of these pretensions, the doctrine of the survival of favored races is a truism, helping scarcely at all to account for the diversity of species. Tolerance plays almost as considerable a part. By these admissions almost the last shred of that teleological fustian with which Victorian philosophy loved to clothe the theory of evolution is destroyed. Those who would proclaim that whatever is, is right, will be wise henceforth to base this faith frankly on the impregnable rock of superstition and to abstain from direct appeals to natural fact. My predecessor said last year that in physics the age is one of rapid progress and profound scepticism. In at least as high a degree this is true of biology, and as a chief characteristic of modern evolutionary thought we must confess also to a deep but irksome humility in presence of great vital problems. Every theory of evolution must be such as to accord with the facts of physics and chemistry, a primary necessity to which our predecessors paid small heed. For them the unknown was a rich mine of possibilities on which they could freely draw. For us it is rather an impenetrable mountain out of which the truth can be chipped in rare and isolated fragments. Of the physics and chemistry of life we know next to nothing. Somehow the characters of living things are bound up in properties of colloids, and are largely determined by the chemical powers of enzymes, but the study of these classes of matter has only just begun. Living things are found by a simple experiment to have powers undreamt of, and who knows what may be behind?

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Watching the effect of German shells at Antwerp from a Belgian armored automobile.

A world's record for milk production is reported in *Hoard's Dairyman* to have been made recently by a 7-year-old Guernsey cow, May Rilma, which in a 365-day test gave 19,639.5 pounds of milk, containing 1,059.59 pounds milk fat.

French Cuirassiers on the march.

An Army on the March

Orderly Sequence in Which the Units of a Modern Army Are Brought Up to the Battle Front

Battery of French field artillery.

ONE of the most important elements in the conduct of warfare is the rapid and orderly movement of the troops, whether in bringing them up to the front from the various mobilization centers, or in moving them from point to point, according to the exigencies of the campaign—the ever-changing fortunes of the field of battle.

To the layman, who has witnessed the gathering and dispersal of the few thousand spectators at a football or baseball game, it will be evident that the movement of bodies of men, running into the hundreds of thousands, is a matter calling for thorough forethought, method, and discipline.

The first German army of invasion of France (1,200,000 men), if marching on a single road, would have stretched from Paris 1,200 miles, to within 350 miles of Moscow.

A train of commandeered Paris autobusses passing through the forest of Compiegne.

As far as possible and almost invariably the march of armies, especially in settled countries, such as form the theater of the present European war, is carried out upon the highways. The order of march, the sequence of the various units, has been determined by long experience, and the diagram which incloses three sides of this page and represents a division of about 20,000 men, when on the march in the presence of the enemy, may be taken as broadly representative of a similar unit in any of the first-class armies engaged in the present conflict. Two such divisions constitute an army corps of 40,000 men, and three army corps make up a field army of 120,000 men.

Now the first thing, probably, that will surprise the layman in looking at this diagram, is the extraordinary length of road that is covered by 20,000 troops on the march. The distance from the head of the advance cavalry to the last wagon of the supply train is 21½ miles. This means that if it were advancing by a single road and were covered by a single body of advance cavalry serving for all the troops that followed, an army corps would reach 41 miles and a field army for a distance of 120 miles.

It has been estimated by some of the military critics that the German army of invasion of France was composed of 1,200,000 men. If so, and the Germans could have marched unopposed into Paris, and if we imagine that army marching by a single road, stretching from west to east, at the time when the advance cavalry reached the Arc de Triomphe, Paris, the tail of the German host would be 1,200 miles distant. The column would reach through France, Belgium, across Germany and some 500 miles beyond the Prusso-Russian boundary to within 400 miles of the city of Moscow.

The enormous size of modern armies necessitates advance upon a wide front and

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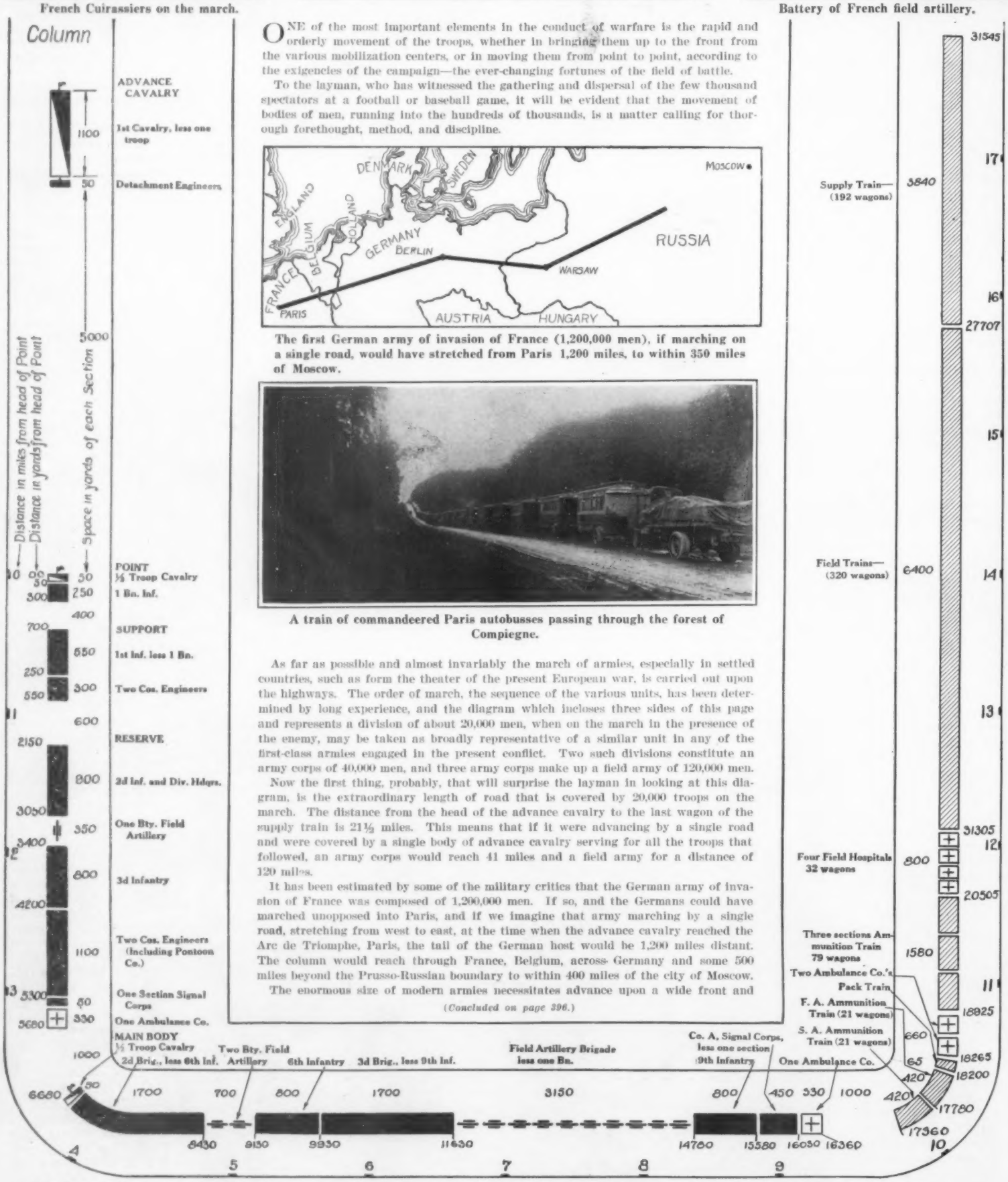
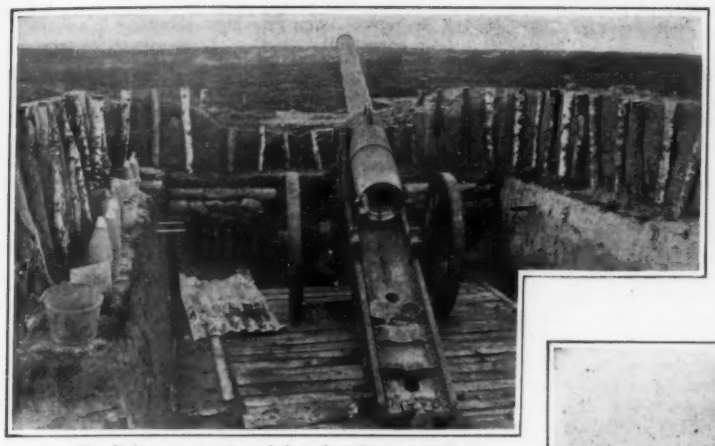


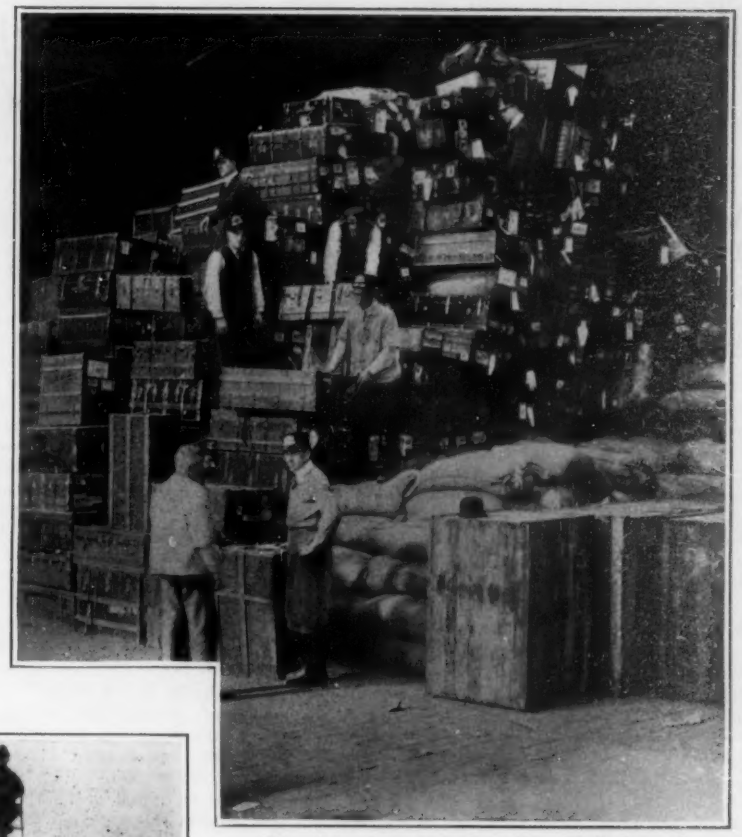
This diagram, drawn to scale, shows the length of road occupied by the various units of a division of 20,000 men on the march in the presence of the enemy.

AN ARMY ON THE MARCH

Bomb-proof shelter abandoned by the Germans.

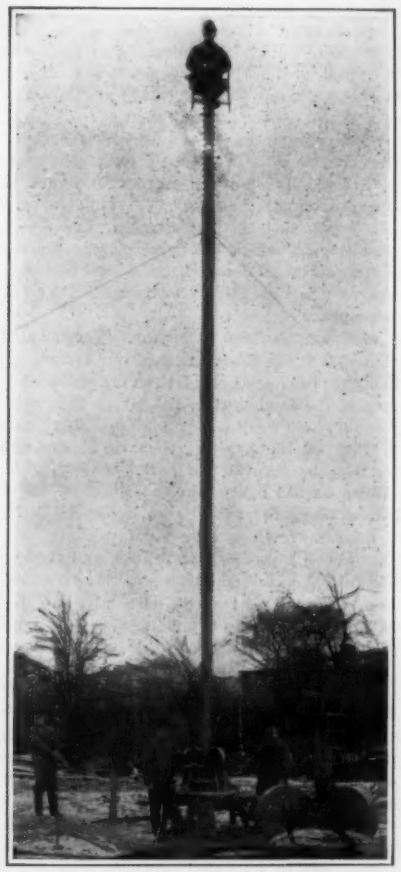


English gun captured by the Germans at Antwerp.



Pile of trunks returned to New York from the war zone.

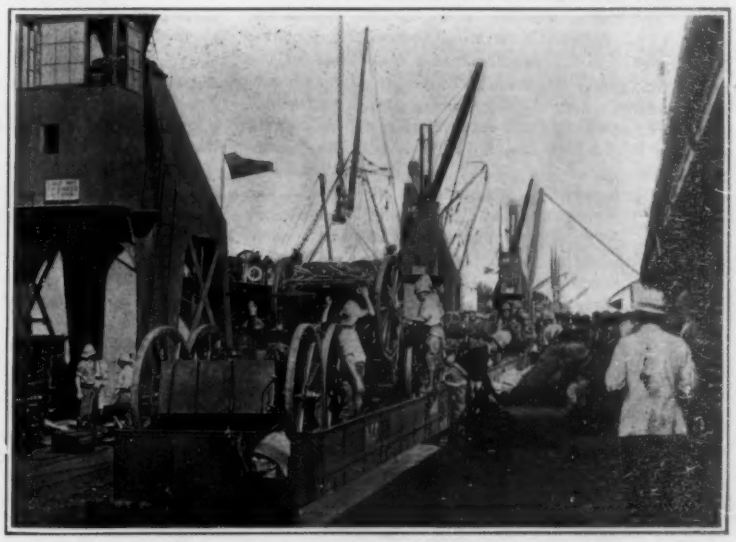
Air-cooled machine gun on an aeroplane.



Mast built of steel ribbons.

Observation post at the top of the mast.

Inexperienced military motorcyclist has an accident.



Loading guns at Capetown for the European war.

PICTURES FROM THE FRONT

Letters from the Firing Line

Tricks of Warfare

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

WAR! All the efforts of our brains, all the descriptions which we have read again and again, all the visions of battles which we have tried to conjure up in our overheated imaginations, do not approach the terrible reality. He who has seen this frightful yet magnificent spectacle with his own eyes will retain the memory of it forever.

All along the roads and the fields can be seen the vestiges of numerous trenches. We have fought here ardently for a month, and slowly, step by step, we have forced the enemy to retire.

In the north they have filled up the ditches where the corpses lay deep, and it now might be considered as one continuous, one endless grave. Every now and then an insufferable odor chokes you. A soldier, a horse has fallen there, and slowly is decomposing. It has been impossible to gather all the bodies in the vast trenches.

The roar of the cannon is heard in the north, however; it is hardly possible to define exactly where the shell fell. This morning my regiment met on the road another regiment: "Well! What are you doing?" we ask. "Digging! And you?" "The same—nothing but digging."

At the actual hour the armies can be classed in two categories—one half is digging trenches in order to fight and the other half is fighting to dig trenches.

A study of our trenches will show why the progress of the armies is so slow. They outline most of the trenches as they have been established by the enemy. The infantry when entering them are entering real fortresses. They are sheltered from view, from the shells and from the rain.

Neither our artillery nor our infantry can see the Germans encaved in them. To reach them it is necessary that our shells fall exactly in the trenches. The battle is no more a fight in the open; the offensive takes the character of a hunt; the danger everywhere comes from underground. Before fighting the enemy we must unearth him.

Moreover, when we realize that the German artillery has also its fortified works; that everywhere it surrounds itself with wire netting in order to stop the assailants; that between the cannon mitrailleuses are concealed, the purpose of which is to act against our infantry; and that behind the field artillery is placed the heavy artillery, whose far-reaching shells are able to protect the retreat with a wall of fire, then we can understand the effort demanded of our troops to displace the German army from its positions and to drive it from the woods and the hills where it seemed to have taken root.

The Germans have come on the battlefield with a certain number of tricks and stratagems which, during the first five weeks of the war, gave them a certain superiority. But the French race is endowed with a prodigious facility of assimilation. It did not take us long to scent the tricks and to adapt ourselves to the German stratagems. In fact, at the very moment I am writing these lines, our infantry is executing some works of art which, in the matter of strength, durability, and finish, can compete with all the mole-traps that the Germans left behind them as samples, at the time of their swift retreat from the Marne last September. The officers of the engineering staff had only to give the measurements and the men started the work. The regiments of reservists and territorials have even succeeded better at first than those of the active army, and the reason of this is that they are composed of a marvelous gathering of all professions and all capabilities. The farmers took the pick-ax to dig; the bricklayers were given charge of the battlements (*crenelage?*) the wood-cutters busied themselves with the hewing of poles and brush for roofings, the plumbers laid out the drainage ditches, and French wit not losing an opportunity, the painters and sculptors erected some amusing statues made of clay at the back of the merlons, destined to protect us from shells.

Many times the Germans, in order to deceive the aim of our guns, dug dummy trenches, where they placed dummy soldiers, surmounted with dummy helmets. These were made of a handful of straw, which they had rolled and plaited, and whose point they had dipped in brass paint. But in the matter of dummy trenches they had nothing on us, and we had a few good ones up our sleeves, which I am not permitted to disclose now, but which I hope I will have, later on, the pleasure of describing at length. The Germans have already had a taste of it; it is dangerous for them to try a bout with French wit.

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In fact, our trenches are so comfortable that we hate to leave them. One of my friends, who stayed eight days in his, had worked a great many improvements, which made it look almost like a home. He had dug an excavation to be used in the capacity of a cupboard, where he would store his food; a sort of step made of soft earth proved a fairly acceptable pillow, and he had given the proper inclination to the board that was his bed—in a word, it was a real subterranean palace.

To verify the accuracy of the fire of their artillery the Germans are very ingenious. For instance, they will send a reconnoitering party of Uhlans, which marches straight ahead and gets into contact with the position of the Allies, and which then signals these positions to their artillery. To this effect they select the high steeples of our churches, using them as gigantic torches.

They climb to the summit of the church steeple, pour gasoline on the woodwork and set fire to it. As soon as the Germans notice this signal their artillerymen see where to aim and know exactly where they must direct their fire.

Spying is one of the great features of German strategy. Among many others, here is one of the cunning ways used very frequently among the German spies: Some men dressed as civilians and placed in different spots occupied by the enemy give the Germans the indication of our positions by means of fires of certain colors during the night, and of smoke in the chimneys of the houses during the day.

Pretended peasants have been discovered in the fields whose occupation was to gather information. German officers, dressed as civilians, were also found in the localities evacuated, their purpose being to establish some connection with their own troops. One was found in a high steeple, where his presence was given away by the strange oscillations of the clock's hands, which had been for the time being transformed into an improvised semaphore.

The women also help in spying. They watch the embarkment and disembarkment of our troops.

It has just been discovered that the spies who kept the army of the famous Gen. von Kluck informed were using a very old way of proceeding, very romantic indeed, that of the gypsies, the vagabonds, and the tramps, who, as a means of corresponding with each other draw varied figures on the walls of the farms and houses along the road. One thinks he is looking at the artless drawings of a child, while these awkward lines have a precise significance, and the smallest detail is full of meaning. Moreover, the German spies have lately copied a burglar's trick, and this is how: On the walls are seen some simple drawings, which do not attract attention, and before which no one would stop. The design, for instance, represents a cow, the face is artlessly drawn, however easily discernible. Sometimes the cows are of small dimensions, or medium, or very big. Some are looking one way, some another. Certain of them have the head raised toward the sky. These cows were drawn by the scouts. A small cow meant that the road was poorly guarded; a bigger one that there were French troops in the neighborhood; and a still bigger cow that a fort or some important work of, defense was to be found near by. To render the information more precise, the orientation of the cow's head gave indications as to the dangerous spots to be avoided, or to be watched. As for the cows looking toward the sky, their meaning was that before advancing any farther it was necessary to explore the surrounding country.

There are many tricks that we must accept as belonging to warfare, and that we ourselves practise when the occasion comes.

A regiment of our cavalry sighted a German battery, which was near and was firing in the opposite direction. Concluding that the Germans were not aware of their presence, the French charged the enemy. In the valley a wire net, cleverly hidden, had been stretched by the Germans; our calavry was caught in the trap, and the German battery, changing its aim, turned its fire upon our troops, who lost heavily.

By way of retaliation we have played more than one trick upon them. For instance, a French general, through his wit, forced the evacuation of a German stronghold. He first opened fire upon it with a great many pieces of artillery, reducing their fire one by one as if the shells of the enemy had silenced them. One only was left to work. The silenced pieces had been sent, without attracting the attention of the Germans, to a position where they had entire command of their entrenchment. Their order was to reach their destination as quietly as possible and to await the signal of attack. As soon as this signal was given they opened fire and the enemy was completely routed.

A method which is frequently employed by our army to demoralize the enemy is to send, at night, a detachment of heavy cavalry across the German bivouacs; this detachment sets fire to the army convoys, the automobiles, emptying over the ground the cans of oil and gasoline, and causes great material losses, besides terrorizing the troops of the enemy.

A scout aviator had flown a good distance over the German territory. On his return his motor was stalled, making it necessary for him to descend. Suddenly some German soldiers with an officer appeared from behind a thicket. The aviator was completely dressed in leather and nothing showed his nationality. In a tone of authority he ordered the officer in German to come to his aid, and the latter hurried to obey. A few minutes afterward the aviator resumed his flight. When he had reached a safe distance the aviator sent to these Germans a paper, on which he had scribbled his thanks for the assistance they had given to a Frenchman.

Persian Lambskins and Karakul Sheep.

WHAT is "Persian lamb"? This fur is well known in America, yet trustworthy information concerning it is hardly to be found in any of our encyclopedias or other reference books.

According to a bulletin just published by the Department of Agriculture, true Persian lamb does not come from Persia, but from Bokhara, and not from the young of the breed of sheep known as Persians, but from karakul or Arabi sheep. The Persian lambskin is known by such other trade names as krimmer, astrakhan, and broadtail, these terms denoting somewhat different grades, but practically all the skins come from Bokhara and adjacent parts of Russian Turkestan. They are now greatly in demand in this country, a single firm in New York importing from 200,000 to 250,000 skins a year. The result of this demand has been extensive crossing of the sheep, so that, it is said, there are not more than 5,000 pure-bred karakuls in existence, most of which are found on the estates of Bokharan noblemen. Their exportation from Bokhara is now strictly forbidden by law.

The karakuls are one of the fat-tail breeds of sheep and are thus described:

"The head is strikingly characteristic of the breed, the face being narrow, and the top of the head and fore part of the skull much rounded. The rams ordinarily have beautiful outspreading spiral horns, but the ewes are generally hornless. The ears are small and pendulous, especially so in the lambs. The face and legs of the adults are covered with short, lustrous black hair, while the wool of the body is coarse, long, and varies in color from gray to black. Very hard outer wool and the absence of soft under wool are said to be indications of purity of blood."

The young lambs are usually jet black, with a lustrous wool closely curled over the entire body. When used for fur, they must be killed when not older than ten days, as the curls open after this period. The practice of using the skin of the unborn lamb, which necessitated killing both lamb and mother, no longer prevails. Good skins sell for from $10 to $15. The ewes are milked for a time after the lambs are killed, and a famous cheese known as Brinza is made from the milk. The mutton of the karakul sheep is said to be the most palatable of any breed, and their fat is used by the Bokharans instead of butter.

Golden-brown lambs are occasionally dropped. This is the color of the prophet Mohammed, and such skins are highly valued in consequence.

The first karakul sheep ever seen in America were imported by Dr. C. C. Young of Belen, Texas, in 1908. Dr. Young published a newspaper article last January describing the many difficulties he encountered in obtaining and bringing over these animals, and the, at first, disappointing results of the attempts to breed them in this country. A few more were imported by him in 1912. According to the Department of Agriculture, flocks have been established in Texas, New Mexico, Kansas, and Prince Edward Island, and numerous experiments in crossing with other breeds have been undertaken, but the results still seem to be problematical. On the other hand, Dr. Young claims that the problem of producing a high grade of Persian lamb in this country has been fully solved.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HEEL PROTECTOR.—J. S. RAMLOSE, 43 Thames St., Newport, R. I. This invention provides a leather covered metal plate which may be secured to the inside of a shoe just above the heel after the shoe is completed or at any time during the course of its wear, and which will prevent nails from tearing stockings and also from injuring the heel of the wearer, thus reducing the danger of blood poisoning or other ill effects.

BOOT AND SHOE.—J. JEPPERSON, 444 South 5th St., East, Salt Lake City, Utah. This invention relates to improvements in boots and shoes and has for an object to provide a structure adapted to connect or draw together the uppers quickly and easily, while presenting means for properly holding the same in position.

HOSE SUPPORTER.—A. M. WILSON, care of A. M. Wilson Co., Cherokee, Iowa. The invention provides a supporter with a button plate having one or more slots, and a button secured thereto, there being a flexible or web member having an opening, through which the button is disposed, this member extending over the button plate and through one or more of the slots, by which means it is held in position on the button plate.

Pertaining to Aviation.

HULL FOR HYDROAEROPLANES.—C. H. FLINT, 48 Henry St., Brooklyn, N. Y. The general objects of this invention are to provide a floating hull for a hydroaeroplane which is of such construction that it has great flotation power, offers comparatively little resistance when traveling in the water, is easy to steer, and possesses great stability, and furthermore, in flight it has a lifting power of its own.

Electrical Devices.

AUTOMATIC TELEGRAPH SYSTEM.—D. H. CAMERON, Box 428, North Sydney, Nova Scotia, Canada. This invention relates to telegraph systems of the automatic type whereby the incoming signals in the form of dots, dashes, and spaces are automatically recorded. The invention improves and simplifies telegraph systems of the above character so as to be more reliable, efficient and expeditious in service; and so designed that only one operator is required to operate the apparatus in receiving a message from one distant station and transmitting it to another distant station.

ELECTRIC LAMP MOUNT.—E. S. KEOGH, 122 Livingston St., Brooklyn, N. Y. This inventor provides a mount for low-voltage electric lamps, to hold the same in operative position upon an electric battery element; provides a means for employing an electric lamp in connection with a single electric-battery element; and provides means for, at will, temporarily or continuously maintaining a closed circuit incorporating a lamp of the character named.

WAVE DETECTOR.—R. T. ACKLEY, Cortland, Ohio. This invention refers to wave detectors of the kind employed in wireless communication, the more particular purpose being to produce a detector which is particularly sensitive to the action of electro-magnetic waves and which is also self-restoring.

ELECTRIC RAT TRAP.—C. W. N. PALMER, R. F. D., No. 1, Mercersburg, Pa. In this trap the rodent is killed by an electric shock and its body deposited in a proper receptacle. Means provide whereby the trap when once operated will automatically reset itself, thus doing away with the necessity of setting the trap each time it is used.

Of Interest to Farmers.

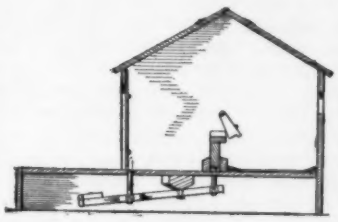
CATTLE GUARD.—H. P. SPENCER, R. F. D., No. 8, Shelbyville, Tenn. This invention refers to cattle guards for preventing the movements of animals along a railroad track, and more particularly to that class of guards including a vertically swinging gate actuable by a platform under the weight of cattle or other animals standing upon the platform.

CHAIN REEL.—A. A. BEALS, Clarence, Mo. The invention relates more particularly to a reel to be used on all types of grain harvesters, such as self-binders, headers, and combined machines, the purpose being to provide a reel which may be mounted low down on the machine frame and which will not interfere in any way with the vision of the operator from his seat.

THRESHING MACHINE.—S. G. GEORGE, Conrad, Mont. In this machine a means provides for dislodging the grain from the straw, so arranged that the grain will be twice acted upon, and wherein means is provided for adjusting the said dislodging means to provide for different conditions, and wherein there will result economy of first cost, upkeep, and amount of grain saved.

CABBAGE HARVESTER.—A. S. WARREN, Batavia, N. Y. The inventor provides a presser member movable rearwardly relatively to the frame for holding the cabbages down to be cut by the knife, this member also serving to push the cabbages upon an elevator or conveyer. Means provide for holding the member yieldingly down and for moving it rearwardly at the same rate of speed that the frame moves forwardly, so that the cabbages will not be turned over should they be pulled up.

TRAP NEST.—A. G. R. KELLER, 1538 Verdi St., Alameda, Cal. This invention relates to trap nests utilized for trapping hens in order that accounts may be kept of the numbers of eggs laid by each hen, and the object of the



TRAP NEST.

invention is to provide a construction for accomplishing this purpose, of such a nature that there will be minimum danger of frightening the birds either as they enter the nest or are trapped therein.

WAGON SCALE.—W. C. PRICE, 314 Juniper Ave., Long Beach, Cal. This inventor provides a scales especially adapted for use in farming districts for the weighing of wagon loads, such as loose hay or like materials, requiring the use of platform scales, such scales being often many miles distant from farms in the farming districts of the West.

STUBBLE BURNER.—A. WARD, Bowbells, N. D. This burner may be moved to a position over the stubble which is to be burned, the frame of the burner carrying an apron at one end and shoes at its side for confining the fire under the top of the burner. The apron and shoes are adjustable to permit of their being raised when the burner is moved over a field and means are provided for spraying oil under the top of the burner, the oil being carried by a tank on the frame.

DITCHING PLOW.—B. A. JORDAN and E. J. TE GROTENHUIS. Address the former, Crawford, Colo. The purpose here is to provide a simple and easily operated device, by means of which a plurality of parallel ditches or grooves may be marked off, wherein the distance between the grooves may be varied at will, as also the depth of the groove.

THRESHER.—G. W. CARPENTER. Address Willard E. Holt, Deming, N. Mex. This inventor provides a machine for beating out and separating grain, peas and beans, and at the same time feeding the straw through the machine, the structure and arrangement being such as that it may be operated with greatly reduced power compared to that necessary in connection with the threshing machines now in general use.

CORN SAVING AND CLEANING DEVICE.—G. A. STEVENS, 520 Center St., Elgin, Ill. This invention relates to means whereby the shelled corn can be saved and collected in clean condition. The fact that the husks and shelled corn are intermingled makes it especially difficult to separate corn in clean condition and at the same time to effect the removal and conveying of the husks.

IRRIGATION DEVICE.—L. B. DEMUTH, Beidler, Ohio. The invention provides a water supply or main pipe with connections from it to a distributing nozzle pipe extending along above the surface of the earth to be irrigated any desired distance, said pipe line or nozzle pipe being provided with perforations for spraying the water laterally from the vertical plane of the pipe.

Of General Interest.

INTERIOR COLLAPSIBLE FORM FOR CONCRETE BURIAL VAULTS.—J. G. JOHNSON, 803 Main St., Carthage, Ill. The purpose here is to provide an interior collapsible form whereby the base, side, and end walls of a concrete burial vault may be conveniently formed in such a manner as to permit of the subsequent formation of a top for the vault whereby the same may be sealed.

ACTION FOR KEYED ZITHERS.—F. MENZENHAUER, 22 Sherman Place, Jersey City, N. J. This invention provides a keyboard attachment for stringed musical instruments of the zither type and arranged to permit convenient adjustment of the actuating parts and to allow of producing a tremolo effect whenever it is desired to do so by the player.

SPOOL HOLDER.—R. FRASER, care of Russell Fraser Wire Co., 128 Wythe Ave., Brooklyn, N. Y. The intention in this case is to provide a holder arranged for convenient attachment to a wall, bench or other support, to allow convenient unwinding of the wire from the spool in length as needed, and to hold the wire on the spool against tangling up.

SHIPPING BOX FOR UMBRELLAS AND CANES.—S. H. ROBERTS, 361 E. 7th St., Brooklyn, N. Y., and G. W. SCHAEFER, New York, N. Y. This invention has reference to an improved shipping box for umbrellas and canes designed more especially to permit the shipping of umbrellas, canes and the like through the mails and by express and to prevent their breakage.

MANUFACTURE OF CELLULOID OR LIKE SUBSTITUTES.—L. L. T. LABBÉ, 2 Rue Henry Say, Asnieres, Seine, France. The present invention has for its object the manufacture of uninflammable substances which are insoluble in water, and which are more particularly intended for replacing celluloid in its various applications. In the process the property of albuminoid solutions of precipitating solutions of silica in the form of collo-silicates, insoluble in water is utilized, and also the employment of the silico-gylceric jelly combined with these collo-silicates.

CLEANING DEVICE.—JERRY CARLETON and A. L. DE LONG. Address the former, Sioux Falls, S. D. One of the principal objects here is to provide a device whereby gasolene, benzine, ether, and other volatile and explosive liquids employed in dry cleaning, as well as soapine and other compounds employed in scouring articles of clothing, laces, tapestry, etc., may be safely, conveniently, and economically used.

Hardware and Tools.

CORK EXTRACTOR.—G. J. DAVISON, 719 East Grace St., Richmond, Va. The purpose here is to provide a combined cork and extractor which will in no way impair the ordinary function of the cork and which has movements to a position beyond the end of the cork when in use and to a position wholly concealed within the cork when in disuse, this movement being limited by means serving to unite the cork and its extractor.

VALVE GRINDING TOOL.—H. R. PARSONS, Sharpsville, Pa. This invention provides an attachment which may be used with a valve grinding tool such as one forming the subject of a patent serial No. 789,651, said attachment adapted to engage valves having a pair of spaced holes or recesses instead of the usual screwdriver slot, whereby the valves may be rotated in grinding the same.

LOCK.—H. ADLER, 1221 Brook Ave., Bronx, New York, N. Y. This inventor provides a lock particularly well adapted for use on elevator doors, the lock having a bolt with a threaded shaft connected with a cylinder or other locking means. A latch bar is provided for engagement by the bolt for locking the latch bar relatively to the bolt.

NOZZLE.—C. J. MYERS, 239 Churchill Ave., Utica, N. Y. This nozzle has a split casing having ports, and means for holding this casing against two companion valve members which have cone-shaped members facing each other, each of the valve members having a projection seated between the casing and the cone-shaped member on the other valve member, the projections being spiral shaped and spaced from the axis of the nozzle, so that one of the valve members may be rotated relatively to the other valve member, to close the opening in the casing between the two ports or to leave a spiral opening through the casing of the nozzle from one port to the other.

Heating and Lighting.

CHIMNEY SWEEPER.—C. E. ANDERSON, Crystal Falls, Mich. This inventor provides a device for cleaning chimneys having other than circular cross-section, capable of being drawn through a chimney, and having mechanism for thoroughly cleaning the walls of the chimney during the passage through the same, and wherein the sweeper is adjustable and capable of cleaning the walls thoroughly, whether or not the chimney is straight.

STOVE.—J. C. ZIEGLER, Wichita Falls, Tex. One of the principal objects here is to provide a heating stove adapted to utilize artificial or natural gas to equal advantage, the construction and arrangement of parts being such that a thorough combustion of the gas is assured and maximum utility of the heat units is attained.

LANTERN.—J. NIELSON, Bandon, Ore. This invention provides a device wherein the chimney is mounted for guided movement toward and from the burner, and is normally spring pressed upward, away from the burner, to facilitate lighting the lantern, and wherein releasable latch mechanism is provided for normally holding the globe in proper position with respect to the burner.

Household Utilities.

WINDOW SHADE.—D. SPIVAK, 491 Oak St., New Haven, Conn. This improvement provides means for ventilating a room provided with a curtain shade, the ventilators being incorporated in the shade; provides a shade with ventilating apertures arranged to obstruct light while giving free access of air; and provides means whereby shades constructed as outlined may be rolled as in the conventional manner.

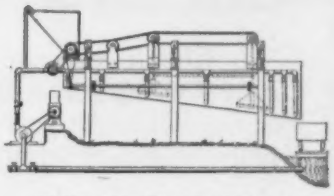
SAD IRON.—C. A. BEACH, 55 Greene St., Brooklyn, N. Y. An object here is to provide a heating structure for sad-irons which may utilize at the will of the operator a plurality of sources of heat supplying fuel. A further object is the arrangement in a sad-iron of heating means formed to utilize a supply of gas and air furnished from either end of the iron.

RECEPTACLE CAP.—J. H. FOLLEN, 214 Exchange St., Kenosha, Wis. This invention refers more particularly to caps for jars or similar vessels. The aim is to provide a cap of sanitary material, such as glass or porcelain, which can be easily removed and cleaned; and which is mounted to positively close the mouth of the receptacle.

IRONING MACHINE.—C. W. SADLER, Box 657, Windsor Locks, Conn. The purpose in this case is to provide a machine in which a number of small cylinders are used and means associated therewith for causing the opposite sides of the matter being ironed to engage some of the cylinders, while still in a moist condition.

Machines and Mechanical Devices.

SLUICE AND ORE CONCENTRATOR.—C. S. RICHARDSON, 336 W. Ave., 51, Los Angeles, Cal. All water is admitted through double-slotted pipes, crossing the bottom of the sluice at intervals of several inches apart, the inner pipe being adjustable so as to give control of the width of the slot, thereby controlling the water admitted. Water is forced into the pipe under pressure and controlled by valves at



SLUICE AND ORE CONCENTRATOR.

either side of the sluice, giving absolute control of both volume and pressure of water at each pipe. An adjustable tail gate puts any portion of all materials in suspension, thereby giving the heavier material a chance to participate. The sluice is hung in an adjustable frame and given an eccentric side motion, which helps in saving exceedingly fine gold, thus increasing the volume of ore run and lessening the amount of water consumed.

DENTAL CASTING MACHINE.—M. MAIER, 150 E. 78th St., Manhattan, New York. Mr. Maier's invention relates to dental casting machines, and has reference more particularly to the centrifugal type in which the molten material is forced into the mold by centrifugal force. The object thereof is to provide a simple device whereby a perfect casting can be obtained.

WINDMILL.—C. L. LONSINGER, Walhonding, Ohio. This invention relates to wind motors or mills of that type in which a plurality of wheels are employed, with the blades of one wheel reversely arranged with respect to the

WINDMILL.

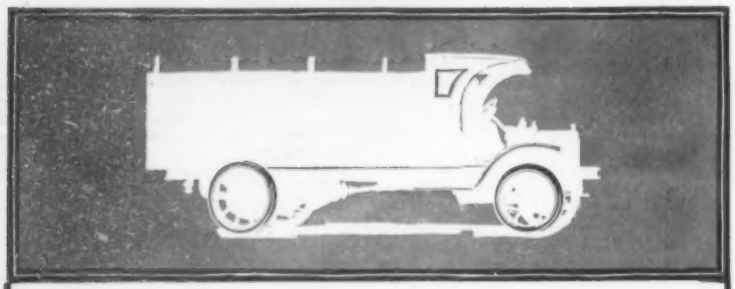
blades of the other wheel, so that the wind after acting on one wheel is deflected by the vanes thereof to act on the other wheel for the purpose of obtaining a greater power from the wind than is possible with a single wheel.

PROJECTILE.—L. F. HERING, Box 266, Pomona, Cal. This device is discharged through the air by means of a plurality of guns of large caliber and great power, and wherein the projectile is in the form of a wheel laden with explosives timed to discharge at a predetermined moment, and provided with laterally extended swords or sabers, and wherein mechanism is provided for supporting the projectile, and for imparting rotation to the flywheel before it is discharged from the guns. Means provide for supporting and guiding the projectile at the commencement of its flight.

LACE MACHINE.—J. FARIGOULE, 40 Rue des Jeuneurs, Paris, France. In the present patent the invention has for its object a machine for the manufacture of all kinds of lace made by hand by means of bobbins, the machine being combined so as to carry out all the operations effected in manufacture by hand.

INGOT MOLD.—H. JOUANNEAU, 11 Rue du Printemps, Paris, France. This invention relates to rotary molds. By means of such a mold rapidly rotated the metal is subjected to centrifugal pressure, with resulting increase of density and cohesion, causing homogeneousness if the metal be single and thorough mixture of elements throughout the mass in the case of

(Concluded on page 398.)



Our 1915 Truck Tire

For fifteen years the Goodyear Tire & Rubber Company has been developing Truck Tires. For the last eight years this work has been principally on heavy service tires.

In this time, the men in our Experimental Department have solved a legion of tire problems. The work they are constantly doing to perfect Goodyear Tires costs us $100,000 a year.

This Goodyear Experimental Department has built 29 different types of Truck Tires. In the evolution of one type—the 1915 Goodyear S. V. Truck Tire—74 separate tire structures were built. Each was watched and tested for utmost efficiency. In the last year and a half 2,100 test tires have been placed in actual use, under every working condition.

The result is the 1915 Goodyear S. V. Truck Tire. This 1915 tire marks today's finality in truck tire service, durability, simplicity, economy. It is the sum of all that has been done in the attainment of truck tire perfection.

No Bolts ★ **No Wedges**

No Flanges ★ **No Bands**

GOODYEAR
AKRON, OHIO
S. V. Truck Tires

Some New Features

The Goodyear S. V. is a metal base tire of the pressed-on type. Wonderfully simple. No tire is applied more quickly, easily or securely. It cannot be applied wrong. There are no rights and lefts.

It is lighter than others—due to a total absence of cumbersome metal wedges, flanges, bolts and bands used to keep other tires in place.

It has a flat tread—which means better load distribution, better traction and a uniform wearing quality.

The metal base is a corrugated channel, to which is vulcanized a layer of hard rubber. Then comes the tread rubber. By a Goodyear process, the metal, the hard rubber and the soft rubber tread are all welded together into one inseparable unit.

Less Cost Per Tire-Mile

Ask us to show you how big concerns in every field are lowering tire-mile costs by using 1915 Goodyear S. V. Truck Tires. Learn also how these tires save equipment—the load—the driver's time—*how they keep the truck in commission.*

Before buying tires remember what Goodyear has done to insure the service and economy you seek. Goodyear S. V. Truck Tires eliminate guess-work and experimentation.

Get Goodyear experience when you buy Truck Tires.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO
Makers of Goodyear No-Rim-Cut Automobile Tires
(1976)

The Japanese Navy

(*Concluded from page 371.*)

45-caliber 6-inch and twelve 45-caliber 4.7-inch guns—an enormous battery to be carried on such a limited displacement. The vessels are protected by a 7-inch belt. Mounting the 12-inch gun, they form an intermediate link between the armored cruiser and the battle-cruiser.

The next step of the Japanese in the development of this type was shown in those fine ships, the "Kurama" and "Ibuki," of 14,600 tons and 22 knots speed. They mount four 45-caliber 12-inch and the 6-inch battery is replaced by eight 45-caliber 8-inch, supplemented by fourteen 50-caliber 4.7-inch guns. These vessels were completed in 1909 and 1910, and both of these ships and the two previously described were designed by the Japanese and built at their yards.

The next Japanese effort was the construction of a battleship, the "Satsuma," of 19,400 tons displacement and 18¼ knots speed. Had the speed been greater, 20 to 21 knots, this ship would have been entitled to rank as a dreadnought, but her moderate speed of 18¼ knots places her in the semi-dreadnought class. Her main battery is extremely heavy, consisting of no less than sixteen large pieces, namely, four 45-caliber 12-inch and twelve 45-caliber 10-inch. There is also a torpedo-defense battery of twelve 45-caliber 4.7-inch guns. The belt is 9 inches in thickness.

In the following year the Japanese completed the dreadnought "Aki," a fine ship of 19,800 tons, 20 knots speed, mounting four 45-caliber 12-inch, twelve 45-caliber 10-inch, and a torpedo battery of eight 45-caliber 6-inch guns. Her belt is 9 inches in thickness. The 12-inch guns are carried in two turrets forward and aft, and the 10-inch guns are mounted in twin turrets, three on each beam.

In 1912 and 1913 the Japanese completed in their yards the dreadnoughts "Kawachi" and "Settsu," of 21,420 tons displacement and 20 knots speed. The battery consists of twelve 45-caliber 12-inch guns and a torpedo battery of ten 50-caliber 6-inch guns. The belt armor is 12 inches in thickness. The six two-gun turrets are distributed on the faulty plan at first favored by Germany, two turrets being mounted on the center line, one forward and one aft, and two on each beam. This system has the defect that four guns are out of action during a broadside engagement.

In the next addition to the navy of four battle-cruisers, the Japanese made a great jump in size, power, and speed. In 1913 they completed at Vickers's Works, the "Kongo," and in the present year at their own yards they built the "Hi-Yei." Two other ships of this class, the "Haruna" and "Kirishima," are under construction in Japanese yards. These fine vessels, of 27,500 tons, are protected by a 10-inch belt, and have a speed of from 27 to 28 knots. They mount eight 45-caliber 14-inch guns and sixteen 50-caliber 6-inch. These ships form a division which, for its speed and fighting power, are equal, if not superior, to any vessels of their class in the navies of the world.

We present a fine wash drawing by Oscar Parkes of a class of four super-dreadnoughts of 30,600 tons displacement, which are under construction in Japanese yards and are down for completion, respectively, in the years 1915, 1916, and 1917. They will be known as the "Kure," "Yukosaka," "Kawasaki," and "Mitsubishi." They will have the great length of 673 feet, and their turbines, of 40,000 horse-power, are expected to drive them at a speed of 22½ knots. The belt armor will be 12 inches at the water-line, with upper belts, respectively, of 9 inches and 8 inches in thickness. They will have the same battery as our "Pennsylvania"; but they will carry their twelve 14-inch guns in six twin-gun turrets instead of four three-gun turrets. The Japanese doubt the wisdom of placing three guns in a single turret, which, if it were disabled, would put one third of the main battery out of action. The torpedo-defense battery will consist of sixteen 50-caliber 6-inch guns, well above the water on the main deck.

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Torpedo Warfare

(*Concluded from page 374.*)

pressure, acts on an immersion servomotor *O*, which, through a rod *G*, operates the immersion or diving rudder. If the torpedo goes too deep, the piston of the pendulum swings forward and the rudders are elevated; the reverse movement taking place if the immersion of the torpedo is not sufficient. When a torpedo dives into the water, the first part of its run is made on a wave line, which crosses and recrosses the desired and ultimate level of immersion, the piston and the pendulum together gradually bringing the torpedo to a true course.

Only a few years ago, comparatively speaking, the lateral course of the torpedo was decidedly uncertain. The range and speed had been greatly improved, but the torpedo still had a way of departing suddenly and mysteriously from its intended course—sometimes coming back at the vessel from which it was sent to the no small dismay of all hands. At this critical stage in the history of the torpedo, the Obry gear was invented. Briefly, the Obry gear consisted of a gyroscope placed within the torpedo and so connected by intermediate power mechanism with the directive rudder that the weapon could be held to a fairly straight course. The original Obry gear had a spring impulse, its directive force rapidly diminishing from the instant of starting, and it became quite useless after the torpedo had run something over a thousand yards. The next developments introduced an air-impulse, turbine-driven gyroscope, and then an electrically driven Obry followed. These have done away with the shock of the original spring impulse and have naturally greatly increased the directive value of the gear, besides making it possible to fire the torpedo from a broadside and cause it to swing automatically through an angle of 90 degrees toward a target dead ahead. From a weapon that was a menace to friend and foe alike, the installing of the gyroscope has revolutionized the automobile torpedo, making it under some conditions even more certain of hitting its mark than even with the biggest of our modern guns.

For years the wonderfully compact and efficient three-cylinder Brotherhood engine was the most reliable motor for the automobile torpedo. The latest torpedoes are driven by a small impulse turbine.

All the while that the torpedo was improving in military value, the range of modern guns on shipboard was likewise undergoing substantial increment, making it possible for ships to fight at greater distances, and the torpedo expert realized, despite all that had been done to make his weapon more effective, that both the range and speed of the torpedo must be further increased if it were to meet properly the changed conditions. At this stage, American inventive skill found a way to surmount the obstacle. Mr. Frank M. Leavitt, of the E. W. Bliss Company, made the startling proposal to heat the air stored in the flask, and thus to cause its expansion and multiply its propulsive capacity. The first American development of the superheater for this purpose consisted of means (see S H in sectional view) by which alcohol could be burned within the air flask—the heated air passing thence through the valve system to the engine or turbine and, while still relatively warm, passing outboard through the exhaust. Apart from propulsive advantages, superheating obviated another objectionable feature of the older system in which the changes of temperature were so great—due to the rapid expansion of the compressed air—that the exhaust was frequently far below the freezing point. This caused the lubricants to congeal and, in turn, impaired the action of moving parts. The British development of the superheater omitted the alcohol flame from within the air flask and put it between the reducing valve and the motor. This was an advantage in some ways: it did not require the heated air to pass through the delicate valve system, it fed into the engine the air at its most efficient temperature, and it made possible a nicer control of the pressure at the engine or turbine. However, like all good things, it had a drawback from a military point of view. When the air flask of one of our torpedoes is fully charged, the actual weight of that compressed air amounts to something like 191 pounds. The reducing valve, which regulates the pressure and supply of air to the motor—standing sentinel between the air flask and the propulsive mechanism—is designed to maintain a feed pressure of 300 pounds for the turbine impulse. When the pressure in the air flask approaches 300 pounds, the run of the torpedo is substantially at an end so far as its useful military speed is concerned. As the air in the air flask expands, due to its gradual escape to feed the motor, the temperature is lowered sometimes even to below zero, and this remaining air is incapable of expelling itself from the flask for the purpose of effecting the propulsion of the torpedo. It has been found that when the superheater is outside of the air flask, of the total weight of 191 pounds of stored energy, not more than about 148 pounds are utilized. Again Mr. Leavitt's ingenuity has supplied a remedy. Instead of heating the air within the flask during the entire run of the torpedo as he first did, he, too, heats the impulse supply outside and between the reducing valve and the turbine, but, in order to make use of more of the stored air than possible heretofore, he causes the ignition of an alcohol flame inside of the flask toward the latter part of the run. By this means he is able to use to good effect 174 pounds of the original 191 pounds of the compressed air, thus increasing the range and the maintenance of higher speeds throughout the longer run.

Without giving away state secrets, the following table will show what the superheater has made possible in the case of an 18-inch torpedo. These figures are very instructive:

Speed in Knots.	Air Unheated.	Air Heated.
At 1,000 yards.....	35	43
At 1,500 yards.....	30	40
At 2,000 yards.....	28.25	38
At 3,000 yards.....	23-24	32
At 4,000 yards.....	18-20	28

The next stage in the development was the production of a 21-inch torpedo, in which the range and speed was increased.

We are not at liberty to give details of this weapon; but it may be stated that the English extreme range of 10,000 yards is probably equalled both in our own 21-inch torpedo and in the latest German type of approximately the same size.

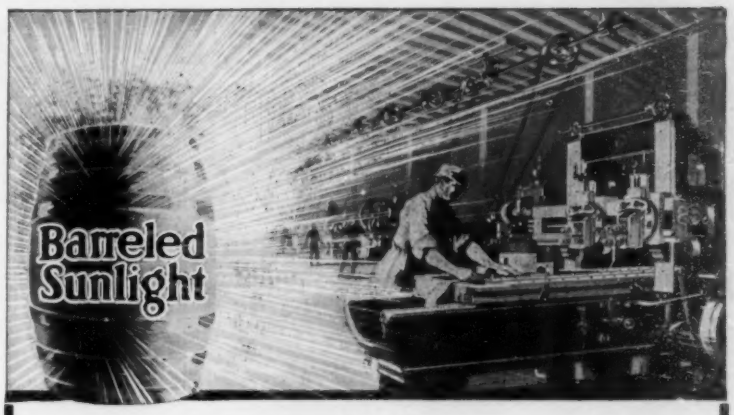
War the Destroyer

(*Concluded from page 375.*)

to a strange paradox. Under certain conditions a company of good shots may be less effective than one composed of inferior marksmen. This is illustrated by the accompanying diagram. Two different groups of men are supposed to be shooting at a company of soldiers arranged in three ranks.

The first group has a rather inaccurate aim, and its *beaten zone*, i. e., the ground over which the impacts of their bullets spread, is long and broad, extending over all three ranks and beyond. Another company, good marksmen, but misled by an incorrect estimate of the range, send their bullets to a much more restricted zone, which falls entirely to reach any of the men of the front rank. It may be remarked here that the error made in estimating range by eye at from 600 to 1,200 yards distance is about 12 to 15 per cent, according to the extent of training. Instrumental range finders are correct to within about 5 per cent, which is about the same as the accuracy attainable by taking the mean of several expert estimates by eye.

The effectiveness of rifle-fire depends not only on accuracy of range, but also upon the rapidity of firing. This varies somewhat with the distance of the target, since a little longer time is required to take an aim at a difficultly discernible object. As an average figure it may be assumed that at a distance from 200 to 400 yards 10 shots per minute can be fired. At 500 to 700 yards this is reduced to 7.5 shots per



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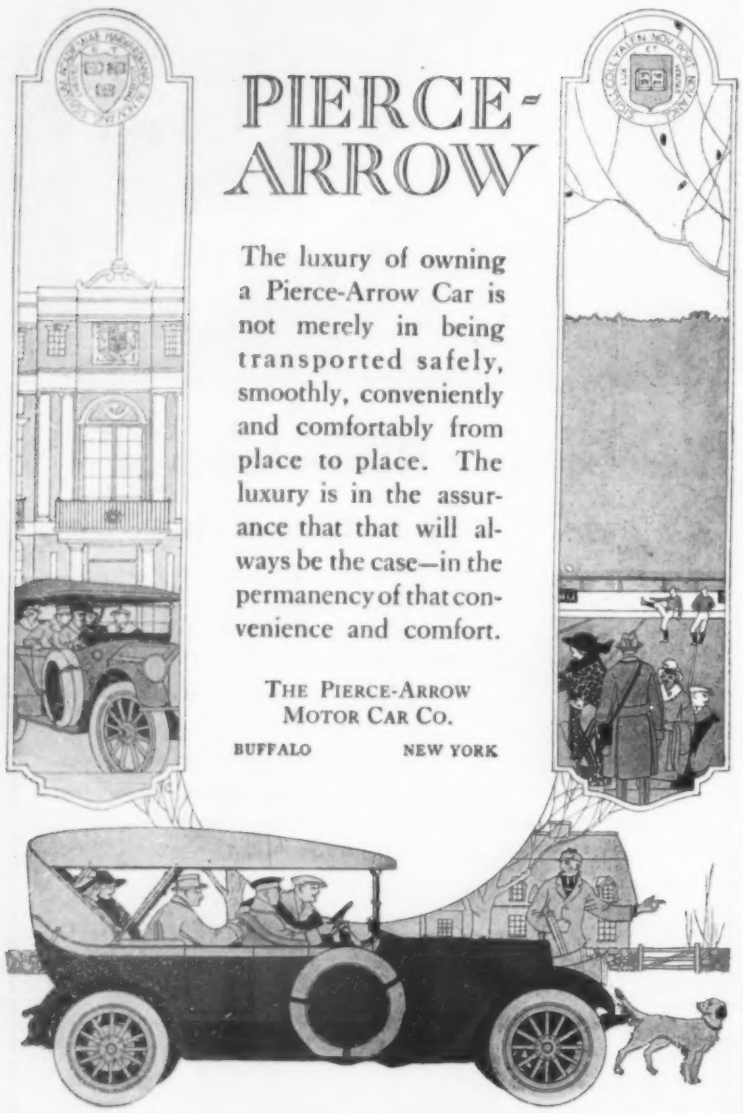

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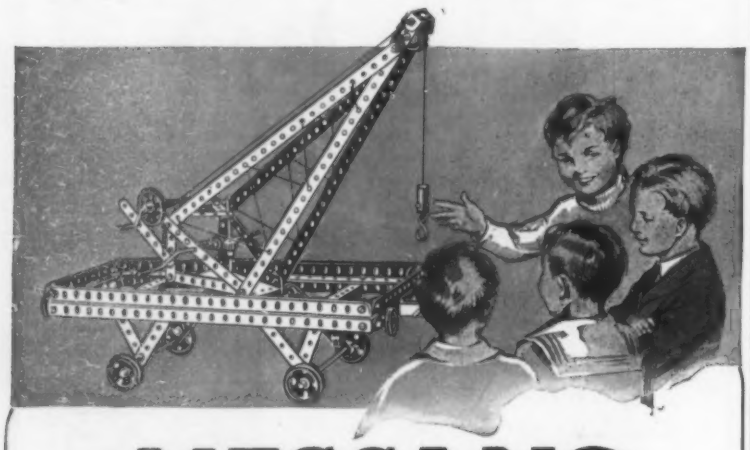

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minute, at 800 to 1,000 yards to 5, and at greater distances to about 3 shots per minute.

Most of the estimates of accuracy of firing are of course based on target practice in time of peace. In actual engagement there is a considerable deterioration of aim for obvious psychological reasons, and it is stated that the dispersion or inaccuracy is under these circumstances from 2 to 4 times as great as in target practice.

Terrible as are the ravages of war, they are far surpassed by some other disasters which from time to time overwhelm the human race. The Franco-Prussian war killed about 130,000 in seven months. The death roll of the Russo-Japanese reached about 200,000. A single earthquake (1737 in India) has been estimated to have caused 300,000 deaths. The fatalities of the Messina earthquake in 1908 cannot have been far short of 100,000. A tidal wave in 1896 drowned 27,000 persons in Japan, causing a greater loss of life than the whole war with China in 1894. The earthquake in Japan in 1703 is said to have killed 200,000 people. The Lisbon earthquake in 1755 destroyed 50,000 human lives, while 40,000 were lost in the same year in earthquakes in Persia.

Terrible as such disasters are, they pass over the multitudes of the human population of our globe as the merest ripples on a mighty sea. The total population of the earth is somewhere about 1,800 millions. Annually there are added to it 14 million souls. Every year at least 80 millions are born, and 60 or 70 millions die. This means a daily birth rate of about 220,000, a death rate of 180,000. The daily increase in population is 40,000. In comparison with this irresistibly swelling tide, what are the greatest battles, wars or earthquakes, but almost microscopic ripples? If we imagine that the power were given to some despot to order a wholesale slaughter, and that guillotines were kept busy beheading one man every minute, night and day, this would add only three quarters of one per cent to the existing death rate!

Compared with the constant and regular causes of death, too, war and catastrophes of nature sink into insignificance. In British India, with a population of 300 millions, 700,000 people die each year of the plague. The infant mortality is responsible for some 3 or 4 million deaths annually in Europe alone, probably for some 25 millions all the world over. If this mortality could be reduced four per cent, one million lives would be saved every year. It is estimated that the decline in the birth rate in Germany since 1906 has reduced the number of annual births by about 180,000. Were it not for a more than compensating diminution in the death rate, the effect of this decline on the population would exceed in a single year the influence of the destruction of Messina. The total number of suicides in Europe alone is from 60,000 to 70,000. Every summer in which the temperature rises above its usual range kills hundreds of thousands of infants in excess of the normal rate. And so on, instances might be multiplied almost indefinitely. The human race is insured with almost infinite security against destruction. A numerical example may serve to illustrate this.

Given ten newborn males, the question may be asked, what are the probabilities that they will all die before reaching the age of reproduction, say 21?

The probability that one individual will reach age 21, is according to life tables, about 0.7, and the probability that he will die before reaching this age is accordingly $1 - 0.7$ or 0.3.

The probability that not one of ten infants will reach the age 21 is, according to well-known principles of the theory of probabilities, the tenth power of 0.3, or $(0.3)^{10}$. This figures out to be about 6 in one million.

If instead of ten males we consider 100, the corresponding probability is expressed as about 1 in 2×10^{52}. The last number, if written out in full, would be a 1 followed by fifty-two ciphers.

This gives some idea of how effectively our race is protected against annihilation

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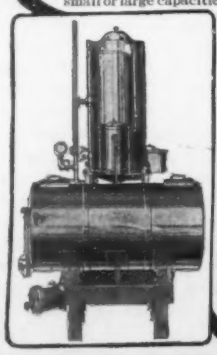

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Medical Science in the Service of War

(*Concluded from page 383.*)

conquered, namely, by means of anti-typhoid vaccination and the education of troops to realize the value of cleanliness. The disease is caused by a microbe which thrives in the walls of the human intestine. It is transmitted when the excreta of the infected person comes into contact with water or food which is afterward consumed by other individuals. In camp the immediate disposal of waste is most important. Flies crawling over exposed excreta, and afterward walking over food in the camp kitchen are a sure means of spreading typhoid fever. Other means of spreading it throughout a camp are through personal contact, such as a man whose hands have become contaminated, subsequently handling food or passing a cigar or cigarette to a comrade, passing a pipe from one mouth to another, tracking germs in on shoes, etc. A common method of spreading typhoid fever is now known to be what are called "bacillus carriers." These are persons who continue to harbor and discharge typhoid bacilli even years after they have convalesced from the disease.

As a rule an attack of typhoid fever renders the subject immune to another attack. After a patient has recovered from the fever certain substances will be found in the blood which are known as antibodies. These bodies appear to be protective, and their presence renders the person immune to another attack of the disease. These protective substances can be produced by "vaccinating" a person with *dead* typhoid bacilli, and this, of course, is a distinct advantage, for while about 3 or 4 out of every 100 who have recovered naturally from typhoid fever, continue to breed and spread the germs, no such condition is possible after vaccination with dead bacilli. Hence vaccination is of the utmost value, especially among troops where one bacillus carrier, because of his ignorance of his condition, may do the greatest harm.

The English were the first to vaccinate their soldiers. This was largely due to the investigations of Sir Almroth Wright. He killed typhoid bacilli by subjecting them to heat, and then tested their effect on animals. He found that the dead typhoid bacilli produced in the blood of the guinea pig substances similar to the antibodies produced in the human blood by an attack of typhoid fever. The British fleet used this new vaccine on the soldiers going to the Boer War. In this instance the soldiers only received one dose, and this, we now know, was not sufficient to produce the desired results. The dose has been increased to three doses administered at intervals of ten days.

Test of Typhoid Vaccination.

In India in 1908 the British vaccinated 6,000 soldiers against typhoid fever, and compared them with a like number not vaccinated. The result of this test was a triumph for the vaccination, for it showed that seven times as many non-vaccinated soldiers contracted typhoid fever, and eleven times as many died. In fact, it was found that the same number of the non-vaccinated died as were taken sick among the vaccinated. Of the number who were vaccinated yet contracted typhoid fever, only four received more than one dose. These four developed very mild cases.

The British and German armies have reported considerable success with anti-typhoid vaccination. The Germans cut the typhoid rate in half during the campaign against the Herreros in Southwest Africa during 1904-07 by the use of the vaccine.

In 1911 vaccination against typhoid was made compulsory for all men in the United States Army under 45 years of age who had not had the disease. The Navy then adopted the same measure, and now both services are believed to be immune. As proof of the immunity, we may take the typhoid figures of a division which was in Florida in 1898, and one which was in

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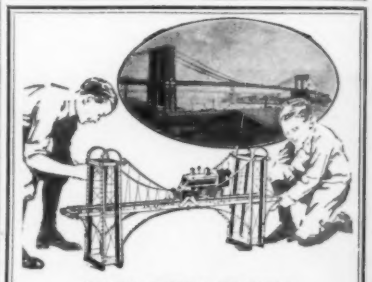

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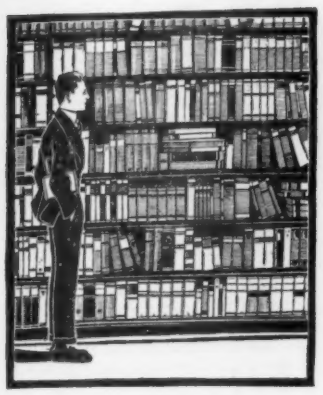

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Texas during the border troubles in 1911. Climate, season, and general conditions were similar. In 1898 there were 2,693 cases of typhoid fever and 248 deaths among 10,759 men; in 1911 there were 2 cases and no deaths among 12,801 men.

While tetanus does not seem to have been the cause of a very high percentage of deaths during other wars, Austria has recognized that it is a factor to be reckoned with. During August that country ordered fifty liters of anti-tetanus serum from the Department of Health of the city of New York.

In the Russo-Japanese war lockjaw infection was more prevalent during the winter campaign than in the summer. This was accounted for by prolonged housing in earth huts, and the proximity of horse manure. In order to avoid tetanus it is necessary to prohibit the men from going about in their bare feet, and to see that wounds are protected against contact with earth, and especially horse manure.

Other diseases to which troops are subject are dysentery, malaria, measles, small-pox, and plague. Measures for the prevention of dysentery are the same as those for typhoid fever, but experiences with vaccines are still too limited to permit any judgment as to their value. The germ of malaria was discovered in 1880 by Laveran, a French army surgeon. The germ is transmitted by a bite of a female anopheles mosquito. After biting a man suffering with malaria and drawing into her stomach the germs of the disease with the blood, the germs developed with the mosquito are injected into the next person she bites. The methods of preventing malaria are the destruction of the breeding places of the mosquitoes, the use of nets and bars to prevent their biting, and the administration of quinine when troops are in a locality where the anopheles mosquitoes abound. In the Union army in the civil war there were 76,000 cases of measles and 5,000 deaths. The only way of preventing the spread of this disease is by isolating the patients. In fact, in an encamped army the first thing which should be done to a sick man is to immediately isolate him. Small-pox has yielded to vaccination. Bubonic plague is caused by a germ which is generally transmitted to human being through the rat flea. Rats are susceptible to the disease, and when they die the fleas are prone to attach themselves to man. Rats should be relentlessly exterminated. Prairie dogs and the ground squirrels of Manchuria are also subject to plague.

Sterilized Water Insures Health.

The most important factor toward maintaining health in a camp is pure water. There are many ways of accomplishing the purification of water. One of the newest and most interesting is by the use of ultra-violet rays, which have marked destructive action on any disease germs which may be present in the water. Water which has been subjected to ultra-violet radiations is rendered sterile without affecting its taste or odor. For field use a sterilizer with a capacity of 150 gallons an hour can be carried on an ordinary gun carriage. The equipment consists of a sterilizer, a gasoline motor for generating electricity, a hose fifteen to twenty feet long to connect the pump with the water supply, and a tripod on which the sterilizer is mounted. The apparatus will deliver sterile water in 5 minutes from the time the motor is started.

The Austrian army is using such an equipment with success. The French used it in Morocco and found that the perfectly sterile water which they obtained was of the greatest value in their military hospital at Oudja. In all the cases of wounds which were washed with water sterilized by the ultra-violet rays they did not have a single case of infection. Among the troops using it entirely for drinking purposes no cases of intestinal disease were observed.

Other methods of purifying water are sedimentation, precipitation and filtration. In sedimentation the water is held in reservoirs that the suspended solids may sink. The clear water is then piped off from the top. Of course this method does not kill bacteria. Precipitation is accomplished by

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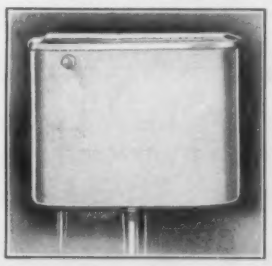

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Scientific American Supplement No. 1644—*Soldering and Soldering Processes,* gives broad general information, and contains in particular a method for pulverizing solders and alloys of great use.

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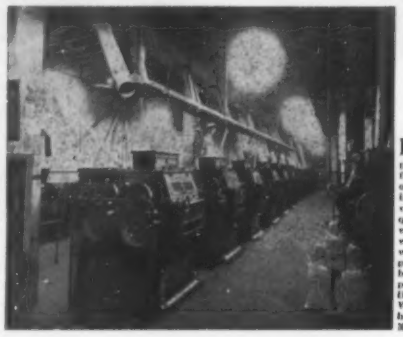

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the addition of chemicals, generally alum, to water in settling tanks. This causes the formation of a gelatinous precipitate which entangles floating particles, even bacteria and causes them to sink. There are several methods of filtration, but except for more or less permanent camps, none are ordinarily used in armies.

Water may be purified by chemical means, but this generally causes a certain amount of unpleasant taste and odor. It has the advantage, however, of rapidity and simplicity. Where vegetable growths abound one part of copper sulphate to a million parts of water will be found satisfactory. Maj. Darnell of the Medical Corps, U. S. A., has devised an apparatus which destroys bacteria in water by means of chlorine gas. This is an economical method costing about 40 cents per million gallons of water.

Ozone, the allotropic modification of oxygen, is also an efficient destroyer of bacteria. For actual field use there have been designed apparatus for use of chlorine, ozone, and the ultra-violet ray. The Japanese used the Ishiji filter in the field during their war with Russia.

The science of warfare and the science of medicine have advanced side by side. The men who are killed outright on the field of battle are beyond the surgeon's aid, but never before in any of the world's wars have as great a percentage of the wounded recovered as will recover in the war which is changing the map of Europe. Science must mend what brutality wrecks. The law of compensation is still in force.

An Army on the March

(Concluded from page 386.)

upon parallel roads, the separate lines of advance keeping in close touch with each other to maintain cohesion and insure a properly co-ordinated arrival on the battle field.

The accompanying diagram of a division on the march is so clearly drawn and fully lettered, that it calls for no detailed description. The order of march is determined, first, by tactical considerations, which, in the presence of the enemy, are of prime importance; and second, by the general principle that the hardships of the troops must be reduced to a minimum. The column is preceded by a strong body of cavalry, who locate and determine the strength of the enemy, and are generally about three miles in advance of the "Point" (see diagram) or head of the main body. Also, a detachment of engineers usually marches near the head of the main column, to repair roads, strengthen bridges, etc.

On the march the troops usually keep to the right of the road. On muddy, sandy, or very dusty roads the column divides longitudinally, thereby making it easier for men and animals to pick their way, the middle of the road being clear.

As far as possible, marches begin in the morning; and, as a rule, foot soldiers do not start before broad daylight, and mounted troops an hour after broad daylight.

The rate of march is regulated by the foot troops. It varies according to the length of the march, size of the body of troops, their condition, and other circumstances. The rate is reduced by sandy, rough, muddy, or slippery roads, great heat and dust, strong head winds, storms, and swampy, hilly or broken country.

For infantry the maximum rate is 3 miles an hour, or, including halts, 2½ to 2¾ miles. Under average conditions the rate of infantry columns is 2¼ to 2½ miles an hour. For large bodies of troops the rate is about 12 miles a day; but small bodies of seasoned troops marching on good roads in cool weather are considered by our army men to be capable of 20 miles per day, though on forced marches this, of course, has been greatly exceeded.

The average march of cavalry, when men and horses are seasoned, is about 25 miles a day.

The daily march of field artillery is about the same as that of the command of which it forms a part. Alone it can cover from 15 to 20 miles.

The daily march of a wagon train is

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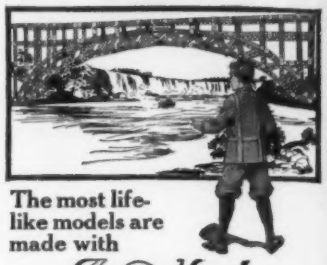

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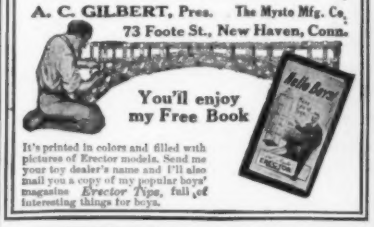

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about the same as that of the infantry.

To rest the men and animals, and for other purposes, a command on the march is occasionally halted. The first halt is made after marching about three quarters of an hour, and is about fifteen minutes long. After the first rest, there is for foot troops a halt of about ten minutes every hour. The men are allowed to fall out, but in the vicinity of their places only. For cavalry the halts are for five minutes only, and for artillery for five to ten minutes.

When contact with the enemy is probable, the columns are closed up and march on broad fronts; communication is maintained between the columns on parallel roads, and all baggage not needed in the conflict is kept in the rear.

Military trains, etc., are at all times provided with the necessary guards, and in marches into action the trains are held far enough in the rear not to interfere with the movements of troops or check withdrawal in case of defeat.

In retreat, the order of march shown in our diagram is reversed.

Failure of the Military Aeroplane Competition

BECAUSE the eleven entrants in the competition for military tractor biplanes failed to file the necessary plans, specifications, and data required under the rules, Major S. L. Reber, the commanding officer in charge of aviation, called off the competition on the 22nd instant, although three machines of well known makers were on hand. These constructors evidently believed that if they produced and flew machines able to fulfill the requirements of the competition, a strict adherence to the rules in the matter of stress charts, angles of glide, and the like would be insisted upon. In this they were mistaken, those in charge evidently deciding that if the engineers of the various constructors were only able to work by rule of thumb, and were incompetent to give the information and drawings demanded, the Army does not want their aeroplanes, no matter how creditably they perform. Then, too, it would not be fair to those contestants who had filed plans but were unable to get their machines to San Diego by October 20th. A re-opening of the competition several months hence will probably be decided upon. In the meantime, if the Army needs up-to-date machines for its few aviators, these can be bought from the constructors.

This competition for tractor biplanes was based on what the best foreign machines have accomplished. Besides a pilot and passenger, each of 150 pounds weight, the aeroplanes were obliged to carry oil and fuel sufficient for a four-hour flight, as well as 450 pounds of deadweight, in all the tests. Construction and workmanship; speed, maximum and minimum; climbing and maneuvering ability; ease of handling; gliding angle; inherent stability; suitability of landing gear, including length of run on the ground in starting and landing; and field of vision, were all to be taken into account in judging the machines. The three best were to have been purchased for $12,000, $10,000, and $8,000, respectively. It was considered doubtful by army aviators if any of the machines could fulfill the climbing test of 4,000 feet in ten minutes when fully loaded. One well-known constructor believed that an aeroplane fitted with a 100 horsepower revolving-cylinder motor would be the only one capable of executing the climbing test. All three machines that put in an appearance were fitted with water-cooled motors of the 8-cylinder V type—a type that has now been adopted by one of the leading automobile firms for their cars. One, which has a motor developing 85 horse-power, flew with a speed variation of 45 miles per hour, and afterwards, piloted by Lieut. H. L. Muller, increased the American height record by 2,303 feet, reaching 17,440 feet elevation. The maximum speed of this machine was 86 miles per hour. One of the remaining two machines, each of which was equipped with 100 horse-power motors, flew the 130 miles from San Diego to Los Angeles, with three aboard, on September 26th.

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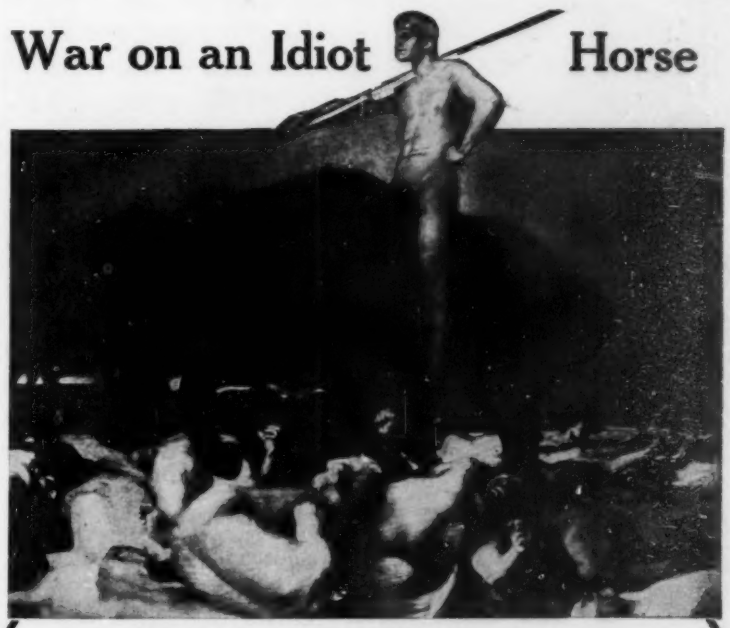
War on an Idiot Horse



This grim figure, stony-faced and relentless, riding an idiot horse rough-shod over his victims, is Franz von Stück's terrific arraignment of war. It is the side of warfare with which ordinary histories are filled—the side with which we have become satiated. But we know only too little about the *causes, the underlying facts, the existing conditions* which for ages have brought about the slaughter of countless thousands. In the remarkable work

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SEPTEMBER 5, 1914

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OCTOBER 3, 1914

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RECENTLY PATENTED INVENTIONS

(Concluded from page 389.)

an alloy. These advantages are especially important in the latter case.

PLUME DRYING APPARATUS.—H. MÉTHOT, 29 W. 34th St., New York, N. Y. In this machine the drying of the plumes is accomplished by the combined action of a blast of heated air directed in the feathers, and of a beater which mechanically agitates the feather to dislodge the particles of moisture and starch therefrom.

CONVEYER.—W. J. TURNBULL, deceased. Address H. W. Hille, Room 306, Wells, Fargo Bldg., New Orleans, La. An object here is to provide a device by means of which a vessel or other similar carrier may be unloaded in a minimum time and at a minimum cost. Another object is to provide a movable conveyer which may be elevated or lowered to accommodate the heights of different vessels.

SLAT CONVEYER.—W. J. TURNBULL, deceased. Address H. W. Hille, Room 306 Wells, Fargo Bldg., New Orleans, La. An object in this case is to provide a conveyer which is of the endless type, but the conveying surface of which is so fashioned as to present a substantially continuous flat surface, thereby preventing loss of material conveyed, while at the same time being capable of passing around the driving wheels at the end of the conveyer.

WASHING MACHINE.—L. YOUNG, care of Andrew Ferrara, 620 Center St., N. Bergen, N. J. This invention relates to washing machines adapted especially for extensive laundry operations. Means provide for the preservation of delicate fabrics by preventing direct wear thereon, and to permit of sufficient clearance for buttons, hooks and the like, on garments being washed, to prevent their being torn out of the garments. The machines may be constructed of substantially uniform or standard size and may be fitted into tubs of varying sizes by cutting off more or less of projections according to each individual tub.

Medical Instruments.

SPECULUM.—F. E. P'POOL, R. F. D., No. 7, Brenham, Tex. This invention provides a yielding device for dilating the orifices of the body under certain conditions; provides a device which will retain its position in the orifice in which it is inserted; and provides a device with means for holding a cleansing material.

Railways and Their Accessories.

CAR GEAR EQUIPMENT.—C. H. BISHOP, 105 N. McComb Ave., El Reno, Okla. This inventor provides mechanism for connection with the body of a railroad car, for causing the brakes to be applied when pressure is exerted on the couplings of the car, wherein draw or coupling bars are provided, mounted to slide on the car body, each of the said bars bearing at its outer end a coupling head, and having mechanism for engaging the brake mechanism of the adjacent truck for applying the brakes, when the coupling bar is moved inward, and wherein spring mechanism provides for normally pressing the coupling bars outward.

RAILWAY SYSTEM.—E. CASTANHO, Rua Paulisto 39, Sao Paulo, Brazil. This system may be embodied in the form of amusement apparatus, or in a railway for general purposes. It is the design of the inventor to provide a railway car and tracks controlled and arranged to promote safety in guarding against derailment of the car.

AUTOMATIC TRAIN STOP.—A. MASTRANGELO, 106 Point Ave., Weehawken, N. J. The purpose of the invention is to provide an inexpensive device with which a modern locomotive can be easily equipped, which will in no way interfere with the normal operation of the locomotive, and which is always in operative position.

Pertaining to Recreation.

REGISTER.—A. W. KEMPNER, care of Oppenheimer & Co., 96 Pearl St., New York, N. Y. This invention has special reference to improvement in registers, and more particularly to a device which may be termed a golfometer, for keeping a count of the number of strokes for each hole and the grand total of strokes for the entire course in playing golf, and also for determining which golf hole is being played.

DOLL BED FRAME.—W. A. REDDICK, Niles, Mich. The invention provides a rocker attachment for the wire frames of doll-beds which are simple and inexpensive in construction and adapted to be easily applied to the legs or posts of the frames for converting the same into rockers if desired.

MECHANICAL ROWBOAT.—R. E. C. WEIR, 287 Baldwin Ave., South Ozone Park, Woodhaven, L. I., N. Y. In this boat, a dummy, in the representation of a person, is pivotally supported and adapted to be oscillated by a connection with a spring or other motor, mounted on the hull near the stern, or otherwise, while the dummy consists of an arrangement of pivotally connected parts to permit a natural movement as in the act of rowing, there being oars attached to the arms of the dummy to cause propulsion of the boat.

Pertaining to Vehicles.

VEHICLE CURTAIN.—C. S. APPLAS, care of Applas Mfg. Co., 922 Fifth Ave., Moline, Ill. This invention provides a manner of arrangement of automobile or other vehicle curtains, including a manner and means of convenient and easy stowage of the curtains when the same

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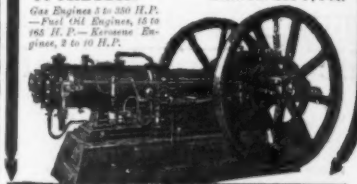

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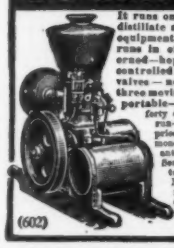

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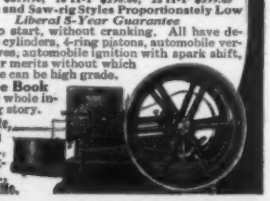

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are not in use, and means for quickly and easily swinging the curtains into position for service, and means for holding them in that position.

SHOCK ABSORBER.—H. A. AHNERT, 170 W. 89th St., Manhattan, N. Y., N. Y. The invention has reference to springs or cushioning devices for vehicles and has particular reference to means for relieving a motor vehicle especially from the objectionable bouncing due to rapid travel over rough or uneven roadways.

AUTO DRIVE.—A. O. TURNER, 935 Twigg St., Tampa, Fla. This drive is especially adapted for heavy trucks and the like, wherein a separate support is provided for the motor and the operating mechanism, the support being connected to the front axle, and having steering mechanism connected therewith, to move the same whereby to guide the vehicle, and wherein the motor is connected with the four wheels, to directly drive the same.

CLIP.—D. B. JACOBS, Apt. 402, 4260 Broadway, New York, N. Y. This clip is more especially designed for use in swingletrees, doubletrees and similar devices, and arranged to permit of quickly and securely attaching the clip without requiring the services of a skilled mechanic, to securely hold the trace holder or the supporting link in position, and to allow of conveniently disassembling the parts for removal and replacement of a worn out part.

PAWL AND RATCHET FOR DUMPING BOXES.—H. F. ROTH, care of Crown Mfg. Co., Sturgis, Mich. The box is adapted to be applied to the running gear of an ordinary wagon, and wherein mechanism is provided for permitting the bottom of the box to be opened into dumping position throughout the entire width of the box, and throughout the entire length between the axles of the running gear to insure the dumping of the contents of the box, and wherein the dumping mechanism is so arranged that the weight of the material dumped insures proper operation of the same.

BUGGY SHAFT SUPPORT.—B. M. PERDUE, Franklin, Ky. The invention is an improvement in that class of devices which are applied to horse drawn vehicles for the purpose of supporting the shafts in elevated position when the vehicle is not in use. It is more particularly an improvement upon that for which Mr. Perdue received Letters Patent of the U. S. No. 1,050,687.

SECTIONAL MUD GUARD FOR MOTOR CYCLES.—H. L. RODERICK, Oroville, Cal. The invention has reference to an improved sectional mud guard for motorcycles, the device being designed to facilitate the removing and replacing of the rear wheel, such as for purposes of repair of the wheel or tire or for putting on a new tire.

Designs.

DESIGN FOR A GAS SAVING ATTACHMENT FOR GAS STOVES.—C. HUBER, Room 1321, 47 W. 42nd St., New York, N. Y. In this ornamental design for a gas saving attachment for a gas stove, the attachment is shown in two views, one perspective and the other sectional.

DESIGN FOR A SANITARY TOOTH CLEANER.—E. G. OVER, care of Libby, McNeill & Libby, Fort Worth, Tex. In this ornamental design for a sanitary tooth cleaner, the device is shown in a plan view of the full side; a plan view of the back of the device; and an enlarged edge view of the device.

DESIGN FOR A SHEET METAL STOVE BODY.—E. C. COLE, care of Cole Mfg. Co., 3218-3238 So. Western Ave., Chicago, Ill. In this ornamental design for a sheet metal stove body, the first view is an end representation of the stove body showing the new design; the second is a plan view of the same; and the third is a side view.

DESIGN FOR A HORN.—E. KAUFMANN, 110 W. 40th St., New York, N. Y. In this ornamental design for a horn, the tube of the instrument from the mouthpiece to the wide flanged open end extends and bends in graceful lines, the upper and lower sections being supported by two miniature harps.

DESIGN FOR A BADGE.—D. M. BRADY, 95 Liberty St., New York, N. Y. In this ornamental design the badge is circular, the inner part comprising a baseball to which wings are attached at one side.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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[*Sci. Am., 11-7.*]

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NEW BOOKS, ETC.

HENDRICKS'S COMMERCIAL REGISTER OF THE UNITED STATES. For Buyers and Sellers. New York: S. E. Hendricks & Co., Inc., 1914. 4to.; 1,596 pp. Price, $10.

The Register is a bulky volume of compact information whose index alone occupies 138 pages. It would be hard to find an article of commerce or industry, from canned goods to portable houses, that is not listed. In any classification which carries a large number of names, as, for example, "architects" and "boilermakers," these names are segregated under their native States, so that reference to particular sections of the country is greatly facilitated. The work includes some 350,000 names and addresses, with 55,000 business classifications. To any whose business interests are connected directly or indirectly with such industries as contracting, engineering, hardware, iron, mill, mining, and railroading, the Register offers a fund of accurate information that is of prime importance both to buyer and seller. Six copies are in constant use in the SCIENTIFIC AMERICAN office, which is a sufficient indication of its value.

THE MAHIN ADVERTISING DATA BOOK. 1913-1914. Facts and Statistics in Condensed Form for the Man who has Advertising and Merchandising Problems to Solve. Chicago: A. C. McClurg & Co. Price, $2.

Perhaps the chief feature of this invaluable little pocket book is the list of towns in the United States and Canada, listed alphabetically by States, and giving population, location, advertising mediums and rates. The population of each State, the number of street cars and the population they serve, and full and half-run rates for street car campaign, are also noted. There are some admirable little articles on advertising practice and principles, and a discussion of types, with illustrations of those most in use. Another eminently useful compilation is that of the leading magazines, trade journals, and religious publications of the country, with their circulation, dates for closing of forms, the size of page and width of column, and their advertising rates and discounts. Advertisers and salesmen will, by keeping these data at hand for constant reference, save much time and increase efficiency. The ten tests applied in judgment of advertising value may not be passed by without a word of appreciation.

MECHANICAL PROPERTIES OF WOOD. Including a Discussion of the Factors Affecting the Mechanical Properties and Methods of Timber Testing. By Samuel J. Record, Assistant Professor of Forest Products, Yale University. New York: John Wiley & Sons, 1914. 8vo.; xi+165 pp.; 51 text figures and half-tone plates. Price, $1.75.

This is a book intended primarily for the use of the student in forestry. Also, the book may well serve as a guide for the mechanical engineer or wood user who wishes to become more familiar with the properties of wood. After a brief introduction, the work very properly begins with the fundamental considerations and definitions which are all reduced to the simplest terms, and without reference to higher mathematics, with which the students are often unfamiliar. This is followed by 46 pages of description of the factors influencing the mechanical properties of wood. Among these are rate of growth, heartwood and sapwood, weight, color, grain, knots, splits, injuries by borers, fungi, water content, temperature, and preservatives. About 10 pages of this chapter are devoted to a consideration of the general effect of the water content upon wood substance. Following this is a brief discussion of the methods employed in preparing and testing the timber and recording data. The methods recommended are for the most part those followed by the United States Forest Service. The whole book is very systematically arranged aud furnishes abundant material for study by everyone who is interested in this important branch of forestry and engineering. There is appended an extensive bibliography made up of books which will be very helpful to those who wish to refer to more complete discussions on certain phases of this subject. Not only are the most familiar books cited, but also a large number of more or less obscure works which are excellent sources for further information. A number of the German and French works given are not readily accessible, however, except to those who are located near large libraries.

MECHANICAL MOVEMENTS, POWERS AND DEVICES. By Gardner D. Hiscox, M.E. New York: The Norman W. Henley Publishing Company, 1914. 8vo.; 409 pp. Price, $2.50.

This volume has been revised a number of times and brought up to date. It contains a large number of valuable mechanical movements and devices, many of which are not found elsewhere. The principal criticism is that the illustrations are dissimilar in character, some of them being catalogue cuts, and others are taken from various technical publications, including the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT. Perhaps it would have been better had all of the illustrations been reproduced uniform in pure line, preferably by the wax process.

MATHEMATICS FOR FRESHMEN STUDENTS OF ENGINEERING. By Theodore Lindquist. 135 pp. A dissertation submitted to the faculty of Ogden School of Science, Department of Mathematics, University of Chicago.

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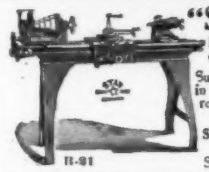

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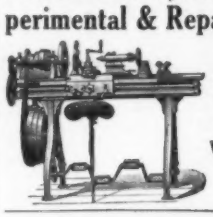

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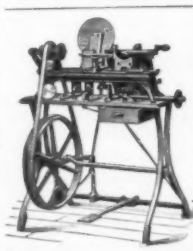

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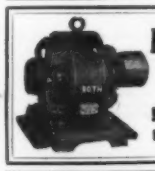

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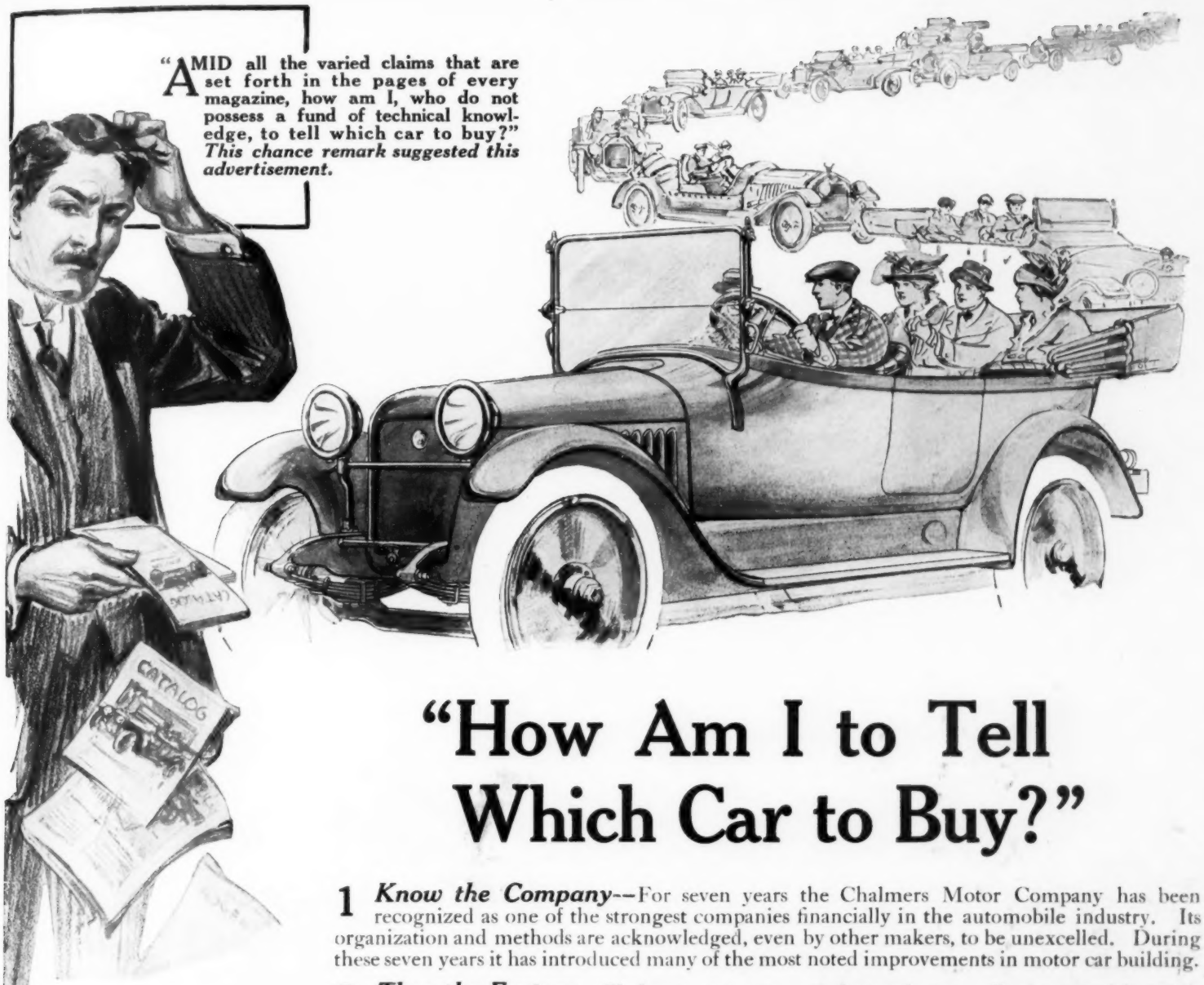

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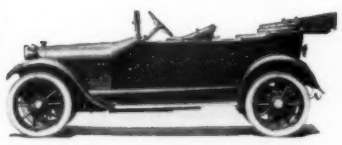
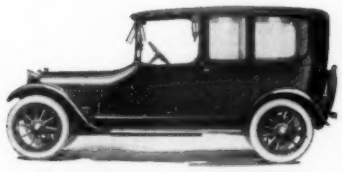


1915 "Light Six" 5 passenger Touring Car—$1650

1915 Chalmers "Master Six" 5-passenger Torpedo—$2400



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"Master Six"—$2400 *Fully Equipped, F. O. B. Detroit*

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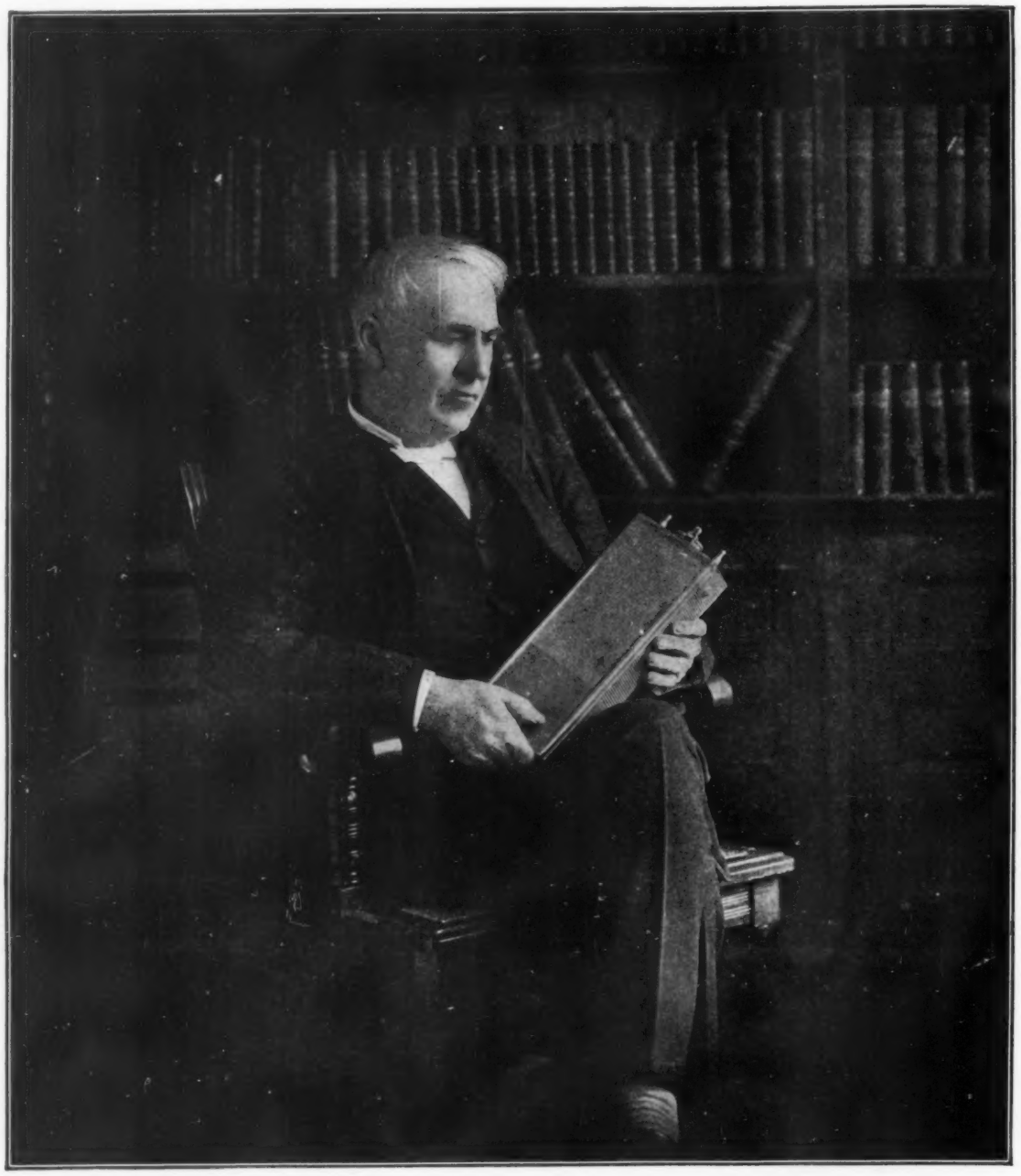

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